OCT 23 192
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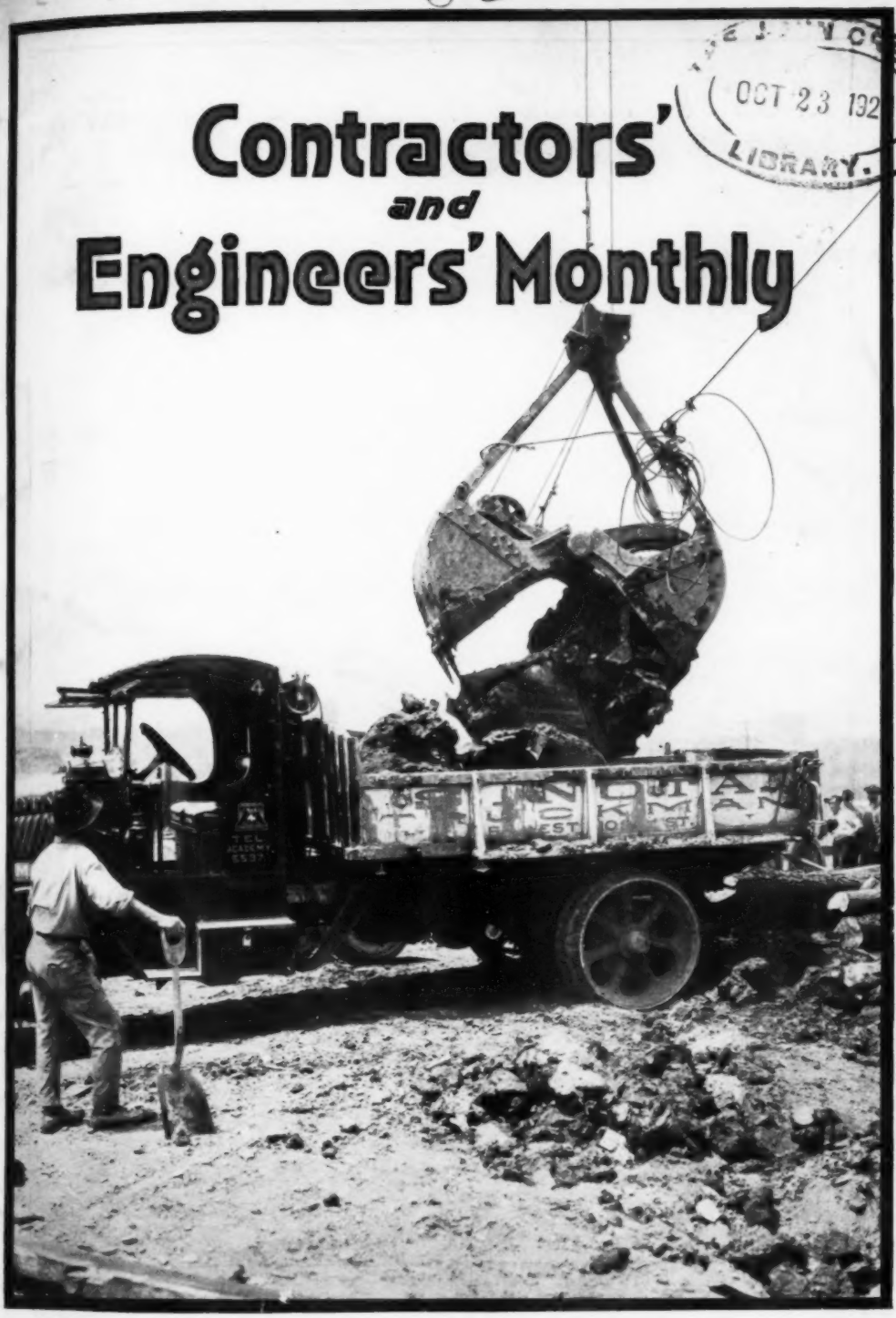
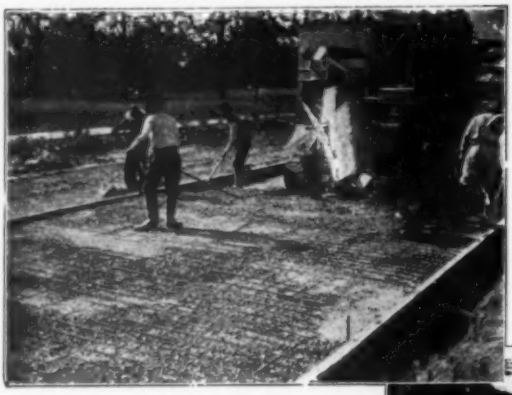
Contractors' and Engineers' Monthly



Excavating for the New Bronx Terminal Market, New York

OCTOBER, 1923 25 Cents $1 a Year

For Better Concrete Roads



Truscon Wire Mesh

Leading highway engineers recognize the value of steel wire mesh in flat sheets for road reinforcement. Truscon Wire Mesh, furnished in widths and areas as desired, comes in flat sheets cut to length. Rigidly connected members keep mesh in perfect form; main members spaced 6 inches and secondary members 12 inches on centers.

Truscon Contraction Joints

Provide a definite plane of weakness in pavement, forming a straight crack for contraction or expansion. The central joint offsets lifting of pavement from subgrade, and serves as a permanent traffic marker. Dowel in plate provides stiffness and interlocking prevents one section rising above the other.

TRUSCON STEEL CO.
Youngstown, Ohio

Warehouses and Offices from Pacific to Atlantic. For addresses see 'phone books of principal cities. Canada: Walkerville, Ont. Export Div.; New York.

TRUSCON
TRUSCON STEEL CO.
WIRE MESH AND CONTRACTION JOINTS

VOL. VII. No. 4 CONTRACTORS' & ENGINEERS' MONTHLY OCTOBER, 1923
Entered as second-class matter, April 16, 1923, at the Post Office at New York, N. Y., under Act of March 3, 1879
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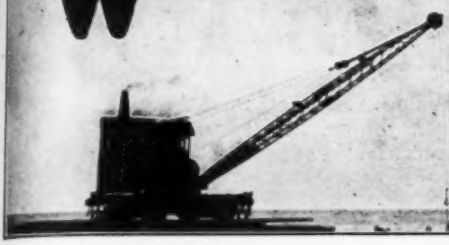
Price 25 Cents, $1 Yearly

Where to Purchase



A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

ACETYLENE
Prest-O-Lite Co., Inc., New York.

ACETYLENE APPARATUS
Air Reduction Sales Co., New York.
Oxweld Acetylene Co., Newark, N. J.

ADDING MACHINES. (See Calculating Machines.)

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York.
De Laval Steam Turbine Co., Trenton, N. J.
De La Vergne Machine Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
General Electric Co., Schenectady, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Nordberg Mfg. Co., Milwaukee, Wis.
Norwalk Iron Works Co., South Norwalk, Conn.
Schramm, Inc., West Chester, Pa.
Sullivan Mchy. Co., Chicago, Ill.
United Iron Works, Kansas City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Worthington Pump & Mchy. Corp., New York.

ARC LAMPS
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ARTESIAN WELL DRILLS AND PUMPS
Am. Well Works, Aurora, Ill.

ASBESTOS PRODUCTS
*Carey Co., Philip, Cincinnati, Ohio.
Darcoid Co., Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.
Mikesel Bros. Co., Chicago, Ill.
Norristown Mag. & Asb. Co., Norristown, Pa.
Sall Mountain Co., Chicago, Ill.

ASH HANDLING MACHINERY
*Haiss Mfg. Co., Geo., New York.
*International Motor Co., New York.
*Robins Conv. Belt Co., New York.
Bartlett & Snow Co., C. O., Cleveland O.
Bay City Dredge Wks., Bay City, Mich.
Brown Hoisting Mach. Co., Cleveland, Ohio.
Byers Mach. Co., Ravenna, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., East Chicago, Ind.
Guarantee Constr. Co., New York.
Jeffrey Mfg. Co., Columbus, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

ASPHALT PRODUCERS
*Barber Asphalt Co., Philadelphia, Pa.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Co., New York.
*Warren Bros. Co., Boston, Mass.
Atlantic Refining & Asphalt Corp., Phila., Pa.
Barrett Co., New York.
Gulf Refining Co., Pittsburgh, Pa.
Headley Good Roads Co., Philadelphia, Pa.
Ky. Rock Asphalt Co., Louisville, Ky.
New Orleans Refining Co., New Orleans, La.
Sinclair Ref. Co., Chicago, Ill.
Standard Oil Co. of Calif., San Francisco, Cal.
Standard Oil Co. of La., New Orleans, La.
Standard Oil Co. of N. J., Newark, N. J.
Standard Oil Co. of N. Y., New York.
U. S. Asphalt Refining Co., New York.

ASPHALT BLOCK
Hastings Pavement Co., New York.

ASPHALT CUTTERS
Dayton Pneumatic Tool Co., Dayton, Ohio.
Chicago Pneumatic Tool Co., New York
Ingersoll-Rand Co., New York.

ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

ASPHALT PLANTS, TOOLS, ETC.
*Barber Asphalt Co., Philadelphia, Pa.
*Connery & Co., Philadelphia, Pa.
*Warren Bros. Co., Boston, Mass.
Austin Machinery Corp'n, Toledo, O.
Bacon Co., Edw. R., San Francisco, Cal.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, Ohio.
Hetherington & Berner, Indianapolis, Ind.

ASPHALT ROLLERS. (See Road and Paving Rollers.)

ASPHALT SURFACE HEATERS
*Barber Asphalt Co., Philadelphia, Pa.
*Equitable Asphalt Maint. Co., Kansas City, Mo.
Hauck Mfg. Co., Brooklyn, N. Y.

BACKFILLERS
*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Austin Machinery Corp'n, Toledo, O.
Byers Machine Co., Ravenna, Ohio.
Constr. Mchy. Co., Waterloo, Ia.
Oshkosh Mfg. Co., Oshkosh, Wis.
Parsons Co., Newton, Ia.
Weller Mfg. Co., Chicago, Ill.

BAR BENDERS AND CUTTERS
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Buffalo Forge Co., Buffalo, N. Y.
Concrete Steel Co., New York.
Electric Welding Co., Pittsburgh, Pa.
Hinman & Co., D. A., Sandwich, Ill.
McKenna Co., Cleveland, Ohio.

BAR CHAIRS, REINFORCING
*Truscon Steel Co., Youngstown, Ohio.
Concrete Steel Co., New York.
Universal Form Clamp Co., Chicago, Ill.

BARS, IRON AND STEEL
Aborn Steel Co., Inc., New York.
Ames & Co., W., Jersey City, N. J.
Bethlehem Steel Co., Bethlehem, Pa.

*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

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ENGINEERING NEWS-RECORD
475 Tenth Ave., New York

Gentlemen:

Please send us a sample copy of your paper and information telling how the Searchlight Section can be used profitably by us.

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Address .....

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Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Midvale Steel & Ordnance Co., Philadelphia, Pa.
Republic Iron & Steel Co., Youngstown, O.
St. Louis Screw Co., St. Louis, Mo.
Sweet's Steel Co., Williamsport, Pa.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
United Alloy Steel Corp., Canton, Ohio.

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*Robins Conv. Belt Co., New York.
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Fairbanks Co., The, New York.
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Union Asbestos & Rubber Co., Chicago, Ill.
U. S. Rubber Co, New York.
Veorhees Rubber Mfg. Co., Jersey City, N. J.

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*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Galion Iron Works & Mfg. Co., Galion, Ohio.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Ransome Concrete Mach. Co., Dunnellen, N. J.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Fairfield Engineering Co., Lancaster, Ohio.
Green Engineering Co., E. Chicago, Ind.
Link-Belt Co., Chicago, Ill.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Weller Mfg. Co., Chicago, Ill.

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BLASTING POWDER (See Explosives)

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Babcock & Wilcox Co., New York.
Biggs Boiler Wks., Akron, Ohio.
Casey-Hedges Co., Chattanooga, Tenn.
Chandler & Taylor Co., Indianapolis, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Cole Mfg. Co., R. D., Newnan, Ga.
Erie City Iron Works, Erie, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Hartley Boiler Works, Montgomery, Ala.
Heine Boiler Co., St. Louis, Mo.
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Ladd Co., Geo. T., Pittsburgh, Pa.
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Neely Nut & Bolt Co., Pittsburgh, Pa.
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Progressive Mfg. Co., Torrington, Conn.
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Rhode Island Tool Co., Providence, R. I.
Russell, Bursdall & Ward Co., Port Chester, N. Y
St. Louis Screw Co., St. Louis, Mo.
Scranton Bolt & Nut Co., Scranton, Pa.
Star Exp. Bolt Co., New York.
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Duff Mfg. Co., Pittsburgh, Pa.
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Waldo Bros. & Bond Co., Boston, Mass.

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Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
Hays Mfg. Co., Erie, Pa.
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Ingersoll-Rand Co., New York City

BRICK, PAVING (See Paving Brick)

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Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Boston Bridge Works, Boston, Mass.
Central States Bridge Co., Indianapolis, Ind.
Champion Bridge Co., Wilmington, O.
Chesapeake Iron Works, Baltimore, Md.
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Clinton Bridge Wks., Clinton, Iowa.
Eastern Bridge & Struc. Co., Worcester, Mass.
Flour City Orn. Iron Co., Minneapolis, Minn.
Fort Pitt Bridge Works, Pittsburgh, Pa.
Ingalls Iron Works Co., Birmingham, Ala.
Inter. Steel & Iron Co., Evansville, Ind.
Lewis-Hall Iron Wks., Detroit, Mich.
Louisville Bridge & Iron Co., Louisville, Ky.
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---for Quick, Efficient, Economical Wiring

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This company realized that many special demands would be placed upon their wiring construction truck. They knew that this truck must be equipped and manned for every emergency. And they let Garford help them solve this problem.

It cost the Pennsylvania-Ohio Power & Light Co. exactly nothing to be ***right.*** A two-cent stamp is all it will cost you. An inquiry will receive the attention of experts. It will not obligate you to buy in the least. Don't hesitate to write.

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Weller Mfg. Co., Chicago, Ill.

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Browning Co., Cleveland, O.
Hayward Co., New York.
Kiesler Co., J. F., Chicago, Ill.
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Mead-Morrison Mfg. Co., East Boston, Mass.
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Williams Co., G. H., Erie, Pa.

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Vulcan Iron Works, Jersey City, N. J.

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Sargent & Co., New Haven, Conn.
Stanley Works, New Britain, Conn.
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BUILDINGS, STEEL (See Bridges and Buildings)

BUNKS AND COTS

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Haggard & Marcusson Co., Chicago, Ill.
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CABLES (See Wire and Cables)

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O'Rourke Eng. Constr. Co., New York.
Petroleum Iron Works Co., Sharon, Pa.

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*Dow Chemical Co., Midland, Mich.
*Solvay Process Co., Solvay, N. Y.
Carbondale Calcium Co., Carbondale, Pa.

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Dalton Adding Mach. Co., Cincinnati, O.
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Marchant Calc. Machine Co., Oakland, Cal.
Monroe Calculating Machine Co., Orange, N. J

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Solar-Sturges Mfg. Co., Chicago, Ill.
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Atlas Car & Mfg. Co., Cleveland, O.
Chase Fdry. & Mfg. Co., Columbus, O.
Easton Car & Constr. Co., New York.
Hunt Co., C. W., W. New Brighton, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Light Ry. Equipment Co., Philadelphia, Pa.
Oliver Mfg. Co., W. J., Knoxville, Tenn.
Stuebner Iron Works, G. L., L. I. City, N. Y.
United Iron Works, Kansas City, Mo.
Weller Mfg. Co., Chicago, Ill.
Whiting Corp'n, Harvey, Ill.

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*Ransome Concrete Mchy. Co., Dunellen, N. J.
*Sterling Wheelbarrow Co., Milwaukee, Wis.
Akron Barrow Co., Cleveland, Ohio.
Etnyre & Co., E. D., Oregon, Ill.
Gray Iron Fdry. Co., Reading, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.
Toledo Wheelbarrow Co., Toledo, Ohio.

CAST IRON PIPE (See Pipe, Cast Iron)

The one best way to absorb expansion

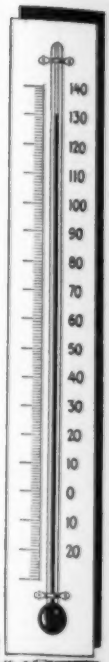
PROGRESSIVE engineers and contractors provide for expansion stresses in concrete, brick and wood block paving, floors, roof decks, rip rap, or other similar construction, or in concrete or masonry bridges, viaducts, stadia, retaining walls or other structures. Better understanding and control of expansion stresses in masonry and concrete has practically eliminated danger of buckling and failure, increased durability and lowered maintenance costs in construction of every type.

Carey Elastite Expansion Joint is recognized as the best of all joint-materials in point of serviceability, the easiest to handle, and the most economically installed. It is a ready-made, "sandwich" joint, resilient and compressible, and does not soften or shatter in extreme temperatures.

The great demand for Elastite Expansion Joint has made possible the economies of quantity production and the organization of national distributing facilities. Seventeen well-located plants in as many large cities have ample stocks for the prompt shipment of rush orders in any quantity.

THE PHILIP CAREY COMPANY
9 Wayne Ave., Lockland, Cincinnati, Ohio

Write for sample and name of nearest city where stocks are maintained, also data giving proper application of joint to various structural conditions and materials.



Carey Elastite
EXPANSION JOINT
PROVED AND ACCEPTED

View of Waterbury-Torrington Road, Connecticut State Highways. Cosmo Vacca, Contractor. Elastite Expansion Joint used transversely and longitudinally.

Carey Elastite Expansion Joint is an asphaltic body, formed of a high-grade asphaltic compound carefully refined and tempered, sandwiched between two walls of asphalt-saturated felt forming an elastic, compressible joint. It is made in lengths, widths and thicknesses as required, can be cut to crown or to any special shape and comes to the job ready to use.

10-23

CASTINGS, STREET AND SEWER

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*Clark Co., H. W., Mattoon, Ill.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
Canton Foundry & Machine Co., Canton, O.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Dee Co., W. E., Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Foundry Mfg. Co., St. Albans, Vt.
Klauer Mfg. Co., Dubuque, Iowa.
Madison Foundry Co., Cleveland, O.
Pechstein Iron Works, Keokuk, Ia.
Sessions Foundry Co., Bristol, Conn.
South Bend Foundry Co., South Bend, Ind.

CATCH BASINS (See Castings, Street and Sewer)

CATCH BASIN CLEANING APPARATUS

*International Motor Co., New York.
Elgin Sales Corp., New York.

CAULKING MACHINERY AND TOOLS

Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Mueller Mfg. Co., H., Decatur, Ill.

CEILINGS, METAL

Berger Mfg. Co., Canton, O.
Canton Art Metal Co., Canton, O.
Newport Rolling Mill Co., Newport, Ky.
Klauer Mfg. Co., Dubuque, Iowa.
Mesker & Co., Geo. L., Evansville, Ind.
Milwaukee Corrugating Co., Milwaukee, Wis.
Wheeling Corrugating Co., Wheeling, W. Va.

CEMENT

*Pennsylvania Cement Co., New York
Ætna Portland Cement Co., Detroit, Mich.
Allentown Portland Cement Co., Allentown, Pa.
Alpha Portland Cement Co., Easton, Pa.
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.
Atlas Portland Cement Co., New York.
Bath Portland Cement Co., Philadelphia, Pa.
Beaver Portland Cement Co., Portland, Ore.
Bessemer Limestone and Cement Co., Youngstown, O.
Bonner Portland Cement Co., Kansas City, Mo.
Canada Cement Co., Ltd., Montreal, Canada.
Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.
Castalia Portland Cement Co., Pittsburgh, Pa.
Clinchfield Portland Cement Corp., Kingsport, Tenn.
Colorado Portland Cement Co., Denver, Colo.
Continental Portland Cement Co., St. Louis, Mo.
Coplay Cement Manufacturing Co., Coplay, Pa.
Cowell Portland Cement Co., San Francisco, Cal.
Crescent Portland Cement Co., Wampum, Pa.
Dewey Portland Cement Co., Kansas City, Mo.
Dexter Portland Cement Co., Nazareth, Pa.
Diamond Portland Cement Co., Cleveland, Ohio.
Dixie Portland Cement Co., Chattanooga, Tenn.
Edison Portland Cement Co., New York.
Fredonia Portland Cement Co., Fredonia, Kans.
Giant Portland Cement Co., Philadelphia, Pa.
Gilmore Portland Cement Corp., Gilmore City, Iowa.
Glens Falls Portland Cement Co., Glens Falls, N. Y.
Golden State Portland Cement Co., Los Angeles, Cal.
Gulf States Portland Cement Co., Demopolis, Ala.
Hawkeye Portland Cement Co., Des Moines, Ia.
Helderberg Cement Co., Albany, N. Y.
Hercules Cement Corp., Philadelphia, Pa.
Indiana Portland Cement Co., Indianapolis, Ind.
International Portland Cement Co., Ltd., Spokane, Wash.
Knickerbocker Portland Cement Co., Inc., New York.
Kosmos Portland Cement Co., Louisville, Ky.
Lawrence Portl'd Cement Co., Northampton, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Portland Cement Co., St. Louis, Mo.
Monarch Cement Co., Humboldt, Kans.
Nazareth Cement Co., Nazareth, Pa.
Newaygo Portland Cement Co., Newaygo, Mich.
Nebraska Cement Co., Denver, Colo.
New Egyptian Portland Cement Co., Fenton, Mich.
New York & New England Cement & Lime Co., New York.
Northwestern States Portland Cement Co., Mason City, Ia.
Ogden Portland Cement Co., Ogden, Utah.
Oklahoma Portland Cement Co., Denver, Colo.
Old Mission Portland Cement Co., San Francisco, Cal.
Olympic Portl'd Cement Co., Ltd., Seattle, Wash.
Oregon Portland Cement Co., Portland, Ore.
Pacific Portland Cement Co., San Francisco, Cal.
Peerless Portland Cement Co., Union City, Mich.
Peninsular Portland Cement Co., Cement City, Mich.
Penn-Allen Cement Co., Allentown, Pa.
Petoskey Portland Cement Co., Petoskey, Mich.
Phœnix Portland Cement Co., Nazareth, Pa.
Portland Cement Co. of Utah, Salt Lake City, Utah.
Pyramid Portland Cement Co., Des Moines, Ia.
Riverside Portl'd Cement Co., Los Angeles, Cal.
San Antonio Portland Cement Co., San Antonio, Tex.
Sandusky Cement Co., Cleveland, Ohio.
Santa Cruz Portland Cement Co., San Francisco, Cal.
Security Cement and Lime Co., Hagerstown, Md.
Signal Mountain Portland Cement Co., Chattanooga, Tenn.
Southern States Portland Cement Co., Rockport, Ga.
Southwest'n Portland Cement Co., El Paso, Tex.
Standard Portland Cement Corp., San Francisco, Calif.
Superior Portland Cement Co., Seattle, Wash.
Texas Portland Cement Co., Dallas, Tex.
Three Forks Portland Cement Co., Denver, Colo.
Tidewater Portland Cement Co., Baltimore, Md.
Trinity Portland Cement Co., Dallas, Tex.
Union Portland Cement Co., Ogden, Utah.
United States Potash Co., Los Angeles, Cal.
U. S. Portland Cement Co., Denver, Colo.
Universal Portland Cement Co., Chicago, Ill.
Vulcanite Portland Cement Co., Philadelphia, Pa.
Wabash Portland Cement Co., Detroit, Mich.
Wellston Iron Furnace Co., Jackson, Ohio.
Western States Portland Cement Co., Independence, Kans.
Whitehall Cement Mfg. Co., Philadelphia, Pa.
Wolverine Portl'd Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Detroit, Mich.

CEMENT GUNS

Cement Gun Co., Allentown, Pa.

CEMENT INSPECTION (See Inspecting Laboratories)

CHAINS

American Chain Co., Inc., Bridgeport, Conn.
Chain Belt Co., Milwaukee, Wis.
Columbus McKinnon Chain Co., Columbus, O.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Niagara Metal Stamp Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CHECK VALVES

*Ludlow Valve Mfg. Co., Troy, N. Y.
Columbian Iron Works, Chattanooga, Tenn.
Lunkenheimer Co., Cincinnati, O.
Mueller Mfg. Co., H., Decatur, Ill.

CHEMICALS FOR WATER PURIFICATION

Du Pont de Nemours & Co., E. I., Wilmington, Del.
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.
Mathieson Alkali Works, Inc., New York.
Penna. Salt Mfg. Co., Philadelphia, Pa.

Backed by Real Service

THE first consideration in choosing any equipment is dependability—select the kind that has proved its freedom from trouble. Then make doubly certain by buying the machine that has real service behind it.

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Hydraulic Hoists and Steel Bodies

The simple Wood-Detroit Hydraulic Hoist, for more than a decade, has demonstrated on many thousands of dump trucks its unequalled dependability. And the Wood-Detroit Service Stations, covering the country from coast to coast, assure a cooperation that enables you to meet any emergency quickly.

Wood-Detroit Simplicity means few vital parts; Wood-Detroit Service prevents delay and loss to you.

Wood Hydraulic Hoist & Body Co.

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CHIMNEYS, CONCRETE
Heine Chimney Co., Chicago, Ill.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, RADIAL BRICK
American Chimney Corp., New York
Custodis Chimney Const. Co., Alphons, New York.
Heine Chimney Co., Chicago, Ill.
Heinicke, Inc., H. R., Indianapolis, Ind.
Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS
*Wallace & Tiernan Co., Inc., Newark, N. J.

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Akron Barrow Co., Cleveland, Ohio
Insley Mfg. Co. Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

CLIPS, WIRE ROPE
American Hoist & Derrick Co., St. Paul, Minn.
Marion Malleable Iron Works, Marion, Ind.
Mockbee & Co., C. M., Cincinnati, O.
Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

COAL AND ORE CONVEYING MACHINERY
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Robins Conv. Belt Co., New York.
Barber-Greene Co., Aurora, Ill.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Brown Hoisting Mchy. Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kon-Wald Co., Buffalo, N. Y.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

COCKS, CURB AND CORPORATION
*Union Water Meter Co., Worcester, Mass.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
Mueller Mfg. Co., H., Decatur, Ill.

COLUMN CLAMPS
*Sterling Wheelbarrow Co., Milwaukee, Wis.
Hydraulic Steelcraft Co., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Universal Form Clamp Co., Chicago, Ill.

COMPRESSORS, AIR (See Air Compressors)

CONCRETE FLOOR HARDENER
*Truscon Laboratories, Detroit, Mich.
Anti-Hydro Waterproofing Co., Newark, N. J.
General Chemical Co., New York.
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonneborn Sons, Inc., L., N. Y. "Lapidolith"

CONCRETE MIXERS
*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Jaeger Machine Co., Columbus, O.
*Atlas Eng. Co., Milwaukee, Wis.
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Austin Machinery Corp'n, Toledo, O.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Gray Iron Fdry Co., Reading, Pa.
Judy Mfg. Co., Centerville, Ia.
Knickerbocker Co., Jackson, Mich.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Marsh-Capron Co., Chicago, Ill.
Milwaukee Concrete Mixer Co., Milwaukee, Wis.
Oshkosh Mfg. Co., Oshkosh, Wis.
Republic Iron Works, Tecumseh, Mich.
Schramm, Inc., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Standard Scale & Supply Co., Pittsburgh, Pa.
Truckmixer Co., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

CONCRETE PILING. (See Piling, Concrete)

CONCRETE REINFORCEMENT
*Truscon Steel Co., Youngstown, O.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
National Steel Fabric Co., Pittsburgh, Pa.
Ryerson & Son., J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., New York.
Youngstown Pressed Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown, O.

CONCRETE ROAD FINISHERS
*Dunn Road Mach. Co., Conneaut, Ohio.
Heltzel Steel Form & Iron Co., Warren, O.
Lakewood Eng. Co., Cleveland, Ohio

CONCRETE TOOLS
*Dallett Co., Thos. H., Philadelphia, Pa.

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York.

CONDUIT RODS
Bissell Co., F., Toledo, Ohio.
Turbine Sewer Machine Co., Milwaukee, Wis.
Waldo Bros. & Bond Co., Boston, Mass.

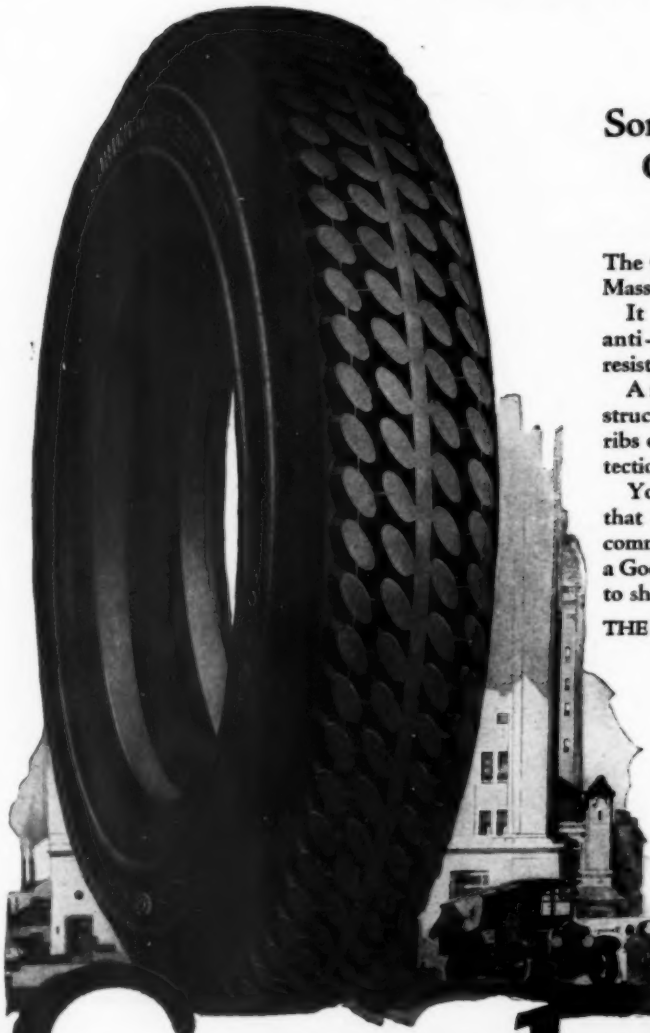
CONDUITS, INTERIOR
American Circular Loom Co., Boston, Mass.
Central Tube Co., Pittsburgh, Pa.
National Metal Molding Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

CONDUITS, UNDERGROUND
American Vitrified Products Co., Akron, Ohio.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Fibre Conduit Co., Orangeburg, N. Y.
Johns-Manville, Inc., New York.
National Fireproofing Co., New York.

CONTRACTORS' SUPPLY DEALERS
(See pages 83-98)

CONTRACTORS' USED EQUIPMENT
*Haetten Co., J. E., New York.
*Kleinhans Co., H., Pittsburgh, Pa.

CONVEYORS, BELT
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Robins Conv. Belt Co., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Barber-Greene Co., Aurora, Ill.
Chain Belt Co., Milwaukee, Wis.



Something New in a Commercial Car Pneumatic

The Goodrich Heavy Duty Cord. Massive, rugged, durable.

It has a scientifically designed anti-skid tread of tough, wear-resisting rubber.

A newly developed sidewall construction reinforced with sturdy ribs of rubber provides extra protection against curb and rut chafing.

You have only to see it, to know that it is the pneumatic tire the commercial car has needed. Ask a Goodrich Truck Tire Distributor to show it to you.

THE B. F. GOODRICH RUBBER CO.
ESTABLISHED 1870

Goodrich
Heavy-Duty CORD
"Best in the Long Run"

Gifford Wood Co., Hudson, N. Y.
Goodyear Tire & Rubber Co., Akron, O.
Imperial Belting Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Portable Machinery Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Standard Conveyor Co., No. St. Paul, Minn.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CONVEYORS, BUCKET

*Atlas Engineering Co., Milwaukee, Wis.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Hains Mfg. Co., Geo., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Robins Conv. Belt Co., New York.
Bartlett & Snow Co., C. O., Cleveland, O.
Caldwell & Son, H. W., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford Wood Co., Hudson, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Olson & Co., Sam'l, Chicago, Ill.
Republic Rubber Co., Youngstown, O.
Stephens Adamson Mfg. Co., Aurora, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CONVEYORS, GRAVITY

Alvey-Ferguson Co., Cincinnati, O.
Dow Co., Louisville, Ky.
Lamson Co., Syracuse, N. Y.
Mathews Gravity Carrier Co., Elwood City, Pa.
Standard Conveyor Co., No. St. Paul, Minn.

CRANES, LOCOMOTIVE

*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravena, O.
Davenport Locomotive Works, Davenport, Ia.
Erie Steam Shovel Co., Erie, Pa.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
Thew Shovel Co., Lorain, O.
U. S. Crane Co., Chicago, Ill.

CRANES, OVERHEAD TRAVELING

*Pawling & Harnischfeger Co., Milwaukee, Wis.
Alliance Machine Co., Alliance, O.
Chesapeake Iron Wks., Baltimore, Md.
Champion Engineering Co., Kenton, O.
Milwaukee Electric Crane Co., Milwaukee, Wis.
Morgan Engineering Co., Alliance, O.
Northern Eng. Works, Detroit, Mich.
Shaw Crane Works, Muskegon, Mich.
Shepard Elec. Cr. & Hst. Co., Montour Falls, N.Y.
Toledo Crane Co., Bucyrus, O.
Whiting Fdry. & Equip. Co., Harvey, Ill.

CRANES, WRECKING

Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Industrial Works, Bay City, Mich.

CREOSOTED BLOCKS, TIMBER, ETC.

American Creosoting Co., New York.
American Creosote Works, Inc., N. Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Colonial Creosoting Co., Inc., Bogalusca, La.
Creosoted Materials Co., New Orleans, La.
Georgia Creosoting Co., Brunswick, Ga.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Granite City, Ill.
Republic Creosoting Co., Indianapolis, Ind.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

CREOSOTING AND CREOSOTING OILS

Am. Creosote Wks., Inc., New Orleans, La.
Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

CRUSHERS, HEAVY DUTY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buchanan Co., C. G., New York.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Worthington Pump & Machy. Corp., New York.

CRUSHERS, ROCK

*Austin-Western Road Mach. Co., Chicago, Ill.
*Galion Iron Wks. & Mfg. Co., Galion, Ill.
*Good Roads Machinery Co., Kennett Square, Pa.
*Universal Road Machinery Co., Kingston, N. Y.
Acme Road Machy. Co., Frankfort, N. Y.
Case Threshing Mach. Co., J. I., Racine, Wis.
Chalmers & Williams, Chicago Hts., Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York.
Lewistown Fdry. & Mach. Co., Lewistown, Pa.
McLanahan Stone Mach. Co., Hollidaysburg, Pa.
Morgan Engineering Co., Alliance, O.
New Holland Mach. Co., New Holland, Pa.
Smith Eng. Wks., Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Universal Crusher Co., Cedar Rapids, Ia.

CULVERTS, METAL

*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Galion Iron Works & Mfg. Co., Galion, Ohio.
*Good Roads Machinery Co., Kennett Square, Pa.
*Newport Culvert Co., Newport, Ky.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmington, Ala.
Canton Culvert & Silo Co., Canton, O.
Concrete Form Co., Inc., Syracuse, N. Y.
Dee Co., W. E., Chicago, Ill.
Dominion Metal Products Corp., Roanoke, Va.
Florida Metal Products Co., Jacksonville, Fla.
Hardesty Mfg. Co., The R., Denver, Colo.
Klauer Mfg. Co., Dubuque, Ia.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Madison Foundry Co., Cleveland, O.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

CURB BOXES

*Clark Co., H. W., Matteon, Ill.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Foundry Mfg. Co., St. Albans, Vt.
Madison Foundry Co., Cleveland, O.
Mueller Mfg. Co., Decatur, Ill.
Thompson-Fleming Co., Inc., Buffalo, N. Y.

CURB GUARDS, STEEL

*Godwin Co., W. S., Baltimore, Md.

CURB, STEEL PROTECTED

*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., New York.
National Steel Fabric Co., Pittsburgh, Pa.
Steel Protected Concrete Co., Philadelphia, Pa.

CUTTERS, PIPE, HAND

Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., New Haven, Conn.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp'n., Greenfield, Mass.
Oswego Tool Co., Oswego, N. Y.
Reed Mfg. Co., Erie, Pa.
Walworth Mfg. Co., Boston, Mass.

CUTTERS, ROD AND WIRE

*Koehring Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carolus Mfg. Co., Sterling, Ill.
Carpenter & Co., Geo. B., Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Worthington Pump & Mchy. Corp., New York.

** Indicates that the manufacturer carries an advertisement.* *See index facing inside back cover.*

LITTLEFORD

TAR AND ASPHALT HEATERS
PAVING TOOLS
POURING POTS

Littleford Tar and Asphalt Heaters are made in various styles with a wide range of capacities and are adaptable to use wherever heated bitumens are required. They are made with but one thought in mind and that is giving dependable service in the hands of the user.

Extra heavy construction makes them exceptionally durable and able to withstand hard usage. Proper design gives them the greatest operating efficiency and the compact arrangement makes them easy to handle and move about.

Littleford Tar and Asphalt Heaters have been used by contractors and builders for many years with complete satisfaction. You, too, can secure this dependable service by being Littleford equipped.

SEND FOR COMPLETE CATALOGUE

Manufacturers of Asphalt tampers and smoothers of various sizes

Asphalt Pots for construction and maintenance work

LITTLEFORD BROS.

500 ·EAST ·PEARL ·ST. CINCINNATI ·OHIO

CUTTING AND WELDING APPARATUS
Madeod Co., Cincinnati, O.
Milburn Co., Alexander, Baltimore, Md.
Prest-O-Lite Co., Inc., New York.

DERRICKS, GUY AND STIFF-LEG
American Hoist & Derrick Co., St. Paul, Minn.
Byers Machine Co., Ravenna, O.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Horton Co., John T., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Lincoln Iron Works, Rutland, Vt.
National Hoisting Engine Co., Harrison, N. J.
Sasgen Derrick Co., Chicago, Ill.
Smith, Whitcomb & Cook Co., Barrie, Vt.
Superior Iron Works, Superior, Wis.

DERRICKS, PIPE LAYING
Austin Machinery Corp'n, Toledo, O.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Mueller Mfg. Co., H., Decatur, Ill.

DERRICKS, REVOLVING
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.

DERRICKS, STEEL
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Toledo, O.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, STEEL PORTABLE
Austin Machinery Corp'n, Toledo, O.
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, TRAVELING
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Nat'l Hoisting Engine Co., Harrison, N. J.
Orton & Steinbrenner Co., Chicago, Ill.

DIESEL ENGINES. (See Engines, Oil)

DISTRIBUTING PLANTS, CONCRETE
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Archer Iron Works, Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

DITCHING MACHINES (See Excavators, Ditch and Trench)

DIVIDING PLATES (ROAD)
*Godwin Co., W. S., Baltimore, Md.

DOORS, METAL
Central Metal Products Corp., Canton, Ohio.
Dahlstrom Metallic Door Corp., Jamestown, N. Y.
Friedrich Co., E. H., Holyoke, Mass.
Lawton-Stephens Co., Brooklyn, N. Y.
McFarland Co., J. C., La Porte, Ind.
Penn Metal Co., Boston, Mass.
Riester & Thesmacher Co., Cleveland, Ohio.
Sykes Co., Chicago, Ill.
Thorp Fireproof Door Co., Minneapolis, Minn.

DOORS AND SHUTTERS, STEEL ROLLING
Cornell Iron Works, New York.
Kinnear Mfg. Co., Columbus, O.
Variety Mfg. Co., Chicago, Ill.
Wilson Corp., J. G., New York.

DRAFTING MACHINES
Universal Drafting Machine Co., Cleveland, O.

DREDGES
American Steel Dredge Co., Fort Wayne, Ind.
Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Ellicott Machine Corp'n., Baltimore, Md.
Erie Steam Shovel Co., Erie, Pa.
Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Marion Steam Shovel Co., Marion, O.
Osgood Co., The, Marion, O.
Stockton Iron Works, Stockton, Cal.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

DREDGES, DIPPER
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

DREDGES, HYDRAULIC
Bucyrus Co., South Milwaukee, Wis.
Ellicott Mach. Corp., Baltimore, Md.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

DREDGING PUMPS AND ACCESSORIES
Erie Pump & Engine Wks., Medina, N. Y.

DRILLS, AIR
*Dallett Co., Thos. H., Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, CORE
*McKiernan-Terry Drill Co., New York.
Dobbins Core Drill Co., Inc., New York.
Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.
Sullivan Mach'y Co., Chicago, Ill.

DRILLS, HAMMERS (PNEUMATIC)
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, O.
Ingersoll-Rand Co., New York.
Natl. Elec. Mfg. Co., Pittsburgh, Pa.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, ROCK
*Dallett Co., Thos. H., Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Natl. Elec. Mfg. Co., Pittsburgh, Pa.
Sullivan Machinery Co., Chicago, Ill.
Wood Drill Works, Paterson, N. J.

DRILLS FOR WELLS AND BLAST HOLES (See Well Drilling Machinery)

ENDURANCE

ENDURANCE is the ability to bear and continue in spite of destructive forces. In this respect Newport Culverts are pre-eminent in the culvert field. Made of GENUINE, OPEN-HEARTH IRON (99.875% pure copper alloy), these culverts are the most rust-resisting on the market.

In strength, they have never been found wanting, for under the heaviest fills, with the greatest loads, they have carried the burden without deformation. They are guaranteed to last longer under identical conditions than any other corrugated metal culvert pipe.

Newport Culverts are made in full-round and half-round types, as illustrated, so that city, county and state officials may have a culvert adaptable to every condition.

Newport Culverts endure the ravages of time and rough usage for decades. Let us explain further why we thoroughly believe there is no better culvert made. Send us your name and address.

Newport Culvert Company, Inc.
542 West Tenth Street
Newport, Ky.

DRUMS, HOLDING
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT
Allis-Chalmers Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Ruggles-Coles Eng. Co., New York.
Variety Iron & Steel Works, Cleveland, O.

DRYERS, SAND AND GRAVEL
*Littleford Bros., Cincinnati, Ohio.

DUMP BODIES FOR MOTOR TRUCKS
*Heil Company, Milwaukee, Wis.
*International Motor Co., New York.
*Littleford Bros., Cincinnati, O.
*Wood Hydr. Hoist & Body Co., Detroit, Mich.
Archer Iron Works, Chicago, Ill.
Auto Truck Steel Body Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Columbia Wagon & Body Co., Columbia, Pa.
Horizontal Hydraulic Hoist Co., Detroit, Mich.
Jennings Automatic Dump Body, Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill
Pechstein Iron Works, Keokuk, Iowa.
Simplex Mfg. Co., Connesutville, Pa.
Van Dorn Iron Wks., Cleveland, Ohio.

DUMP CARTS AND WAGONS, HORSE DRAWN
*Austin Western Road Mchy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Acme Road Machinery Co., Frankfort, N. Y.
Acme Wagon Co., Emigsville, Pa.
Austin Mfg. Co., Chicago, Ill.
Columbia Wagon & Body Co., Columbia, Pa.
Eagle Wagon Works, Auburn, N. Y.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Stroud & Co., Omaha, Nebr.
Tiffin Wagon Co., Tiffin, Ohio.
Watson Products Corp., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

DUST LAYING AND ROAD BINDER MATERIALS
*Dow Chemical Co., Midland, Mich.
*Solvay Process Co., Solvay, N. Y.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Co., New York.
Barrett Co., New York.
Carbondale Calcium Co., Carbondale, Pa.
Dustoline for Roads Co., Summit, N. J.

DYNAMITE (See Explosives)

EJECTORS, SEWAGE
Pacific Flush Tank Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC GENERATORS AND MOTORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Ideal Elec. & Mfg. Co., Mansfield, O.
Lincoln Electric Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Western Electric Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC LAMPS
General Electric Co., Schenectady, N. Y.
Westinghouse Lamp Co., New York.

ELECTRIC LIGHTING PLANTS
*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Western Electric Co., New York.

ELECTRIC SUPPLIES, METERS, ETC.
Bissell Co., F., Toledo, Ohio.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

ELEVATORS, BUCKET
*Atlas Eng. Co., Milwaukee, Wis.
*Austin Western Road Machy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Littleford Bros., Cincinnati, Ohio.
*Robins Conv. Belt Co., New York.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

ELEVATORS, PASSENGER, FREIGHT, ETC.
Albro-Clem Elevator Co., Philadelphia, Pa.
Amer. Elevator & Mach. Co., Louisville, Ky.
Bay State Elevator Co., Springfield, Mass.
Haughton Elev. & Mach. Co., Toledo, Ohio.
Kaestner & Hecht Co., Chicago, Ill.
Llewellyn Iron Works, Los Angeles, Cal.
Montgomery Elevator Co., Moline, Ill.
Otis Elevator Co., New York.
Ridgeway & Son Co., C., Coatesville, Pa.
See Elec. Elevator Co., A. B., New York.
Speidel, J. G., Reading, Pa.
Warner Elevator Mfg. Co., Cincinnati, O.
Warsaw Elevator Co., Warsaw, N. Y.

ENGINES, GAS AND GASOLINE
*Climax Engineering Co., Clinton, Ia.
*Hercules Corpn., Evansville, Ind.
*Holt Mfg. Co., Peoria, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, Ohio.
Fuller & Johnson Mfg. Co., Madison, Wis.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
Nelson Bros. Co., Saginaw, Mich.
"New-Way" Motor Co., Lansing, Mich.
Novo Engine Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Wellman-Seaver-Morgan Co., Cleveland, O.
Worthington Pump & Mchy. Corp., New York.

ENGINES, OIL

DIESEL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Busch-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
Dodge Sales & Eng. Co., Mishawaka, Ind.
Fulton Iron Works Co., St. Louis, Mo.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
McIntosh & Seymour Corp., Auburn, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
Western Machy. Co., Los Angeles, Cal.

SEMI-DIESEL

Anderson Fdry. & Mach. Co., Anderson, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Buckeye Machinery Co., Lima, O.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York
De La Vergne Machine Co., New York

For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

Auto Heater and Distributor PATENT COMBINATION

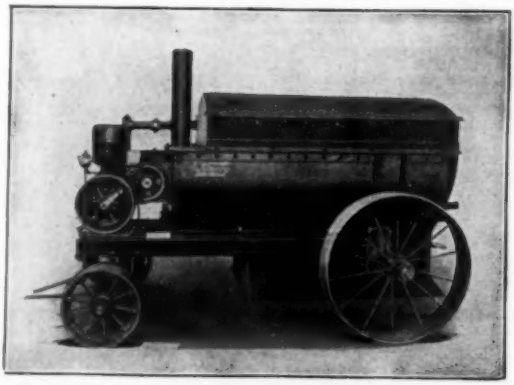
QUALITY Kinney EFFICIENCY

HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of materials, Pump, Piping, Hose, Nozzles, AutomaticallyHeated.

No Steam Required.



Kinney Manufacturing Company

3529 Washington Street

BOSTON, MASSACHUSETTS

BRANCHES:

NEW YORK PHILADELPHIA CHICAGO SAN FRANCISCO HOUSTON KANSAS CITY

Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, O.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.
Muncie Oil Eng. Co., Muncie, Ind.
Nordberg Mfg. Co., Milwaukee, Wis.
St. Mary's Oil Eng. Co., St. Charles, Mo.
Stover Mfg. & Engine Co., Freeport, Ill.
Taylor Machine Co., Cleveland, O.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, PUMPING

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hoover, Owen, Rentschler Co., Hamilton, O.
Murray Iron Wks., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Worthington Pump & Mchy. Corp., New York.

ENGINES, STEAM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dake Engine Co., Grand Haven, Mich.
Erie-Ball Engine Co., Pittsburgh, Pa.
Erie Pump & Engine Co., Medina, N. Y.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY

Bucyrus Co., South Milwaukee, Wis.
Lidgerwood Mfg. Co., New York.

EXCAVATORS, DITCH AND TRENCH

*Keystone Driller Co., Beaver Falls, Pa.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Byers Machine Co., Ravenna, Ohio.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, Ohio.
Bucyrus Co., South Milwaukee, Wis.
Clyde Iron Works Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Fairbanks Steam Shovel Co., Marion, O.
Hayward Co., The, New York City.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

EXCAVATORS, DRAG-LINE

*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Sauerman Bros., Chicago, Ill.
Austin Machinery Corp'n, Toledo, O.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Gade Excavator Works, C. L., Iowa Falls, Iowa
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.
Smith Co., T. L., Milwaukee, Wis.

EXPANDED METAL

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Northwestern Expanded Metal Co., Chicago, Ill.
Youngstown Pressed Steel Co., Warren, O.

EXPANSION JOINT MATERIAL

*Barber Asphalt Co., Philadelphia, Pa.
*Carey Co., Philip, Cincinnati, Ohio.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Texas Company, New York.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.
Barrett Co., New York.
Servicised Products Co., Chicago, Ill.

EXPLOSIVES

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., E.I., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Hercules Powder Co., Wilmington, Del.

FENCING

Adrian Wire Fence Co., Adrian, Mich.
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Nitselman Bros., Muncie, Ind.
Michigan Wire Fence Co., Adrian, Mich.
Page Steel & Wire Co., Bridgeport, Conn.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Iron Works Co., Cincinnati, Ohio.
Texas Cyclone Fence Co., Fort Worth, Tex.
Wickwire Spencer Steel Corp., New York.
Youngstown Sheet & Tube Co., Youngstown, O.

FILING EQUIPMENT, STEEL

Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL

Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER

American Water Softener Co., Philadelphia, Pa.
Graver Corporation, E. Chicago, Ind.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewel Filtr. Co., Nutley, N. J.
Norwood Engineering Co., Florence, Mass.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

FIRE ALARM SYSTEMS

Gamewell Fire Alarm Tel. Co., Newton Upper Falls, Mass.

FIRE ALARM SIRENS

Erick Elec. Siren Co., St. Paul, Minn.
Federal Sign System, Chicago, Ill.
Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Col.
Interstate Machine Prod. Co., Rochester, N. Y.
Sireno Co., Stapleton, N. Y.
Union Water Meter Co., Worcester, Mass.

FIRE APPARATUS, MOTOR

*International Motor Co., New York.
Ahrens-Fox Fire Engine Co., Cincinnati, O.
American-La France Fire Eng. Co., Elmira, N. Y
Brockway Motor Fire App. Co., Cortlandt, N. Y.
Northern Fire Apparatus Co., Minneapolis, Minn.
Foamite-Childs Corp., Utica, N. Y.
Pirsch & Sons Co., Peter, Kenosha, Wis.
Prospect Mfg. Co., Prospect, O.
Seagrave Co., Columbus, O.
Stutz Fire Engine Co., Indianapolis, Ind.
Waterous Fire Engine Co., St. Paul, Minn.

FIRE EXTINGUISHERS, CHEMICAL

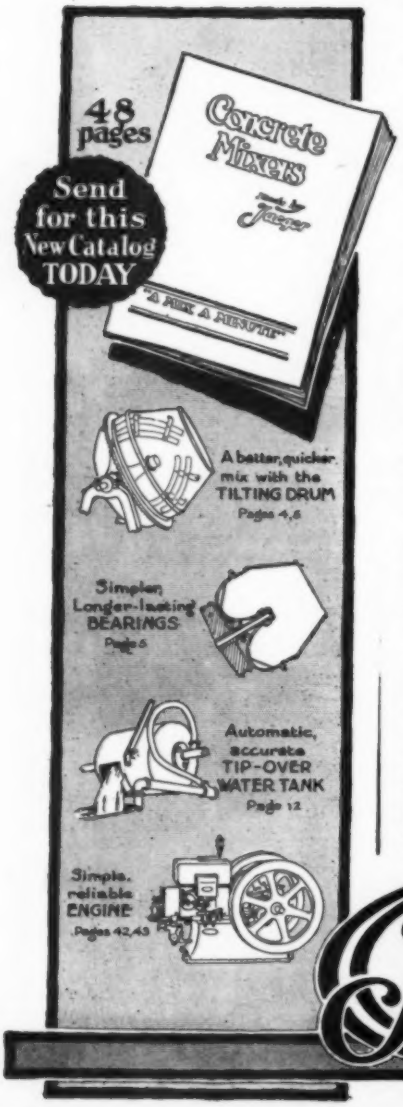
American-La France Fire Eng. Co., Elmira, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite-Childs Co., Utica N. Y.
Pyrene Mfg. Co., Newark, N. J.

FIRE HOSE. (See Hose, Fire)

FIREPROOF BUILDING MATERIAL

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Delaware Clay Products Co., Pittsburgh, Pa.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.

Facts You Should Know Before Buying Any Concrete Mixer



THE new Jaeger catalog fully explains the many superior points of Jaeger construction. It shows how the Jaeger Tilting Drum is shaped and constructed for faster, better mixing; how seven bearings are eliminated; how bigger capacity is obtained with lighter weight.

This new book shows you the famous Tip-over Water Tank that dumps exactly the right quantity of water at the throw of a lever. It tells why the Jaeger power loader increases output of the mixer 50 to 75 per cent. It explains the superior features of the in-built Jaeger hoist. And it gives detailed reasons for superior operation of the Jaeger engine.

Get this catalog and make comparisons. Then you will understand why more Jaegers are sold than any other mixer. Write for this book today.

THE JAEGER MACHINE CO.
701 DUBLIN AVE., COLUMBUS, OHIO

It is infringement to make, use or sell a patented invention without authority under the patent. Our patents have been sustained by the United States Courts in six different instances. Purchasers of our Mixers are protected.

Jaeger
"A MIX A MINUTE"

Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
Youngstown Pressed Steel Co., Warren, O.

FIRST AID EQUIPMENT

American-La France Fire Eng. Co., Elmira, N. Y.

FLEXIBLE JOINTS

*Central Foundry Co., New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
United Lead Company, New York.

FLOORING, COMPOSITION

*Barber Asphalt Co., Philadelphia, Pa.
Am. Mason Safety Tread Co., Lowell, Mass.
Barrett Co., New York.
Johns-Manville Co., H. W., New York.
Marine Decking & Supply Co., Phila., Pa.
Muller, Franklyn R., & Co., Waukegan, Ill.

FLOORS, WOOD BLOCK

Barrett Co., New York.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Servicised Products Co., Chicago, Ill.
Sou. Wood Preserving Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

FLUSH TANKS

Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

FORGES

Buffalo Forge Co., Buffalo, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.

FORM CLAMPS

Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind.
Universal Form Clamp Co., Chicago, Ill.

FORMS, CONCRETE

*Connery & Co., Philadelphia, Pa.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Concrete Form Co., Inc., Syracuse, N. Y.
Hetzel Steel Form & Iron Co., The, Warren, O.
Hydraulic Steelcraft Co., Cleveland, O.
Lakewood Eng. Co., Cleveland, Ohio.
Metal Forms Corp., Milwaukee, Wis.

FOUNTAINS, DRINKING

Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, Jas. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Mott Iron Wks., J. L., New York.
Murdock Mfg. & Supply Co., Cincinnati, Ohio.
Pure San. Dr. Ftn. Co., Haydenville, Mass.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
Stewart Iron Works Co., Cincinnati, O.
Taylor Co., Halsey W., Warren, O.
Twentieth Century Brass Wks., Belleville, Ill.

FURNITURE AND FILES, STEEL

Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works Co., Cleveland, O.

GARBAGE CANS. (See Cans)

GARBAGE DISPOSAL

Balmer Corp., New York.
Bartlett, C. O. & Snow Co., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
Decarie Incinerator Co., Minneapolis, Minn.
Morse-Boulger Destructor Co., New York.
Nye Odorless Crematory Co., Macon, Ga.

GARBAGE TRUCKS AND WAGONS

*Austin Western Road Mchy. Co., Chicago, Ill.
*Heil Co., Milwaukee, Wis.
*International Motor Co., New York.
Autocar Co., Ardmore, Pa.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Lee Trailer & Body Co., Chicago, Ill.
Service Motor Truck Co., Wabash, Ind.
Tiffin Wagon Co., Tiffin, O.
Watson Products Corp., Canastota, N. Y.
White Co., Cleveland, O.

GAS ENGINES. (See Engines, Gas and Gasoline.)

GAS METERS

*Pittsburgh Meter Co., East Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Builders Iron Foundry, Providence, R. I.
Cleveland Gas Meter Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.

GAS PRODUCERS

Camden Iron Works, Camden, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

GASOLINE STORAGE TANKS

*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Biggs Boiler Works, Akron, Ohio.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Byers Machine Co., Ravenna, Ohio.
Chicago Bridge & Iron Works, Chicago, Ill.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Kansas City, Mo.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

GATES, SLUICE

*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.
Hardesty Mfg. Co., The, Denver, Col.

GAUGES, RECORDING, PRESSURE, STEAM

Ashcroft Mfg. Co., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Crosby Steam Gauge & Valve Co., Boston, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
U. S. Gauge Co., New York

GAUGES, WATER

Bristol Co., Waterbury, Conn.
Lunkenheimer Co., Cincinnati, O.
United States Gauge Co., New York.
Walworth Mfg. Co., Boston, Mass.

GAUGES, SURFACE, RESERVOIR AND SPECIAL WATER-WORKS

*Clark Co., H. W., Mattoon, Ill.
Builders Iron Foundry, Providence, R. I.
Simplex Valve & Meter Co., Philadelphia, Pa.

GLASS, FIREPROOF. (See Wire Glass.)

GRADERS, ROAD (See "Road Graders")

GRADER BLADES

*Adams & Co., J. D., Indianapolis, Ind.
Shunk Mfg. Co., Bucyrus, Ohio.

GRAND STANDS, PORTABLE

Leavitt Mfg. Co., Urbana, Ill.
Wayne Iron Wks., Philadelphia, Pa.

GRINDERS AND SAND RAMMERS

Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Ingersoll-Rand Co., New York, N. Y.

GYPSUM PRODUCTS

U. S. Gypsum Co., Chicago, Ill.

HAMMER DRILLS

(See Drills, Hammer.)

The P&H "8-in-1" Feature Increases Returns on Investment

The P & H machines that you are using on dragline excavating or material handling can be readily adapted for other work and increase your returns on the investment.

By replacing the crane boom with the Shovel Boom, you have a shovel of tremendous power and large capacity—a shovel with a real crowding motion that forces the dipper into hard and frozen soils or rocks—a shovel operated like the dragline or crane **by one man.**

The Skimmer Scoop (as shown below) digs up pavement, grades roads, and takes care of shallow excavation work that keeps a train of trucks and wagons busy.

FEATURES:
- One-Man Operated.
- Low Fuel Consumption.
- No Fuel or Water to Haul.
- Interchangeability of Booms.
- No Firing Up Necessary.

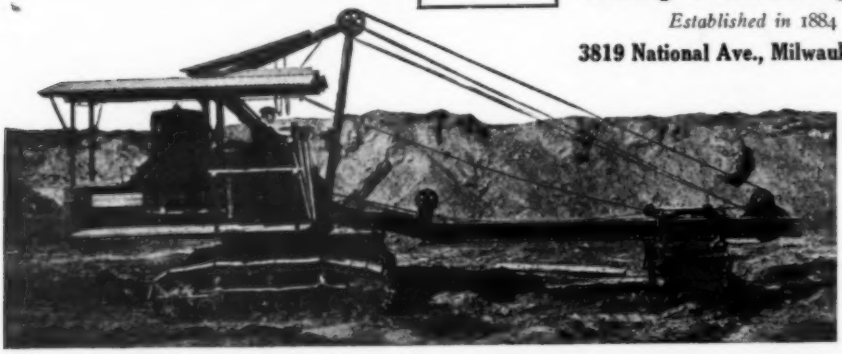
These and other uses as driving piles, handling material with sling chains or electromagnet are illustrated in Bulletin 58-X. Let us mail you a copy.

Excavating Machinery Division

Pawling & Harnischfeger Co.

Established in 1884

3819 National Ave., Milwaukee, Wis.



P&H EXCAVATORS

HAMMERS, STEAM, PILE. (See Pile Hammers, Steam)

HEAT INSULATING MATERIAL

*Carey Co., Philip, Cincinnati, Ohio.
Johns-Manville, Inc., New York.

HEATERS AND DISTRIBUTORS, TAR AND ASPHALT HEATING KETTLES

*Kinney Mfg. Co., Boston, Mass.

HEATING KETTLES. (See Kettles)

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*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Weller Mfg. Co., Chicago, Ill.

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Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.
Mead-Morrison Mfg. Co., E. Boston, Mass.

HOISTS, ELECTRIC

*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Flory Mfg. Co., S., Bangor, Pa.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Street Bros. Mach. Wks., Chattanooga, Tenn.
Treadwell Eng. Co., Easton, Pa.

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*Pawling & Harnischfeger Co., Milwaukee, Wis.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Austin Machinery Corp'n, Toledo, O.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Clyde Iron Works Sales Co., Duluth, Minn.
Construction Machy. Co., Waterloo, Iowa.
Domestic Engine & Pump Co., Shippensburg, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Lansing Co., Lansing, Mich.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Monighan Machine Co., Chicago, Ill.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Novo Engine Co., Lansing, Mich.
O. K. Clutch & Mach. Co., Columbia, Pa.
Orr & Sembower, Reading, Pa.
Schramm, Inc., West Chester, Pa.
Street Bros. Mach. Wks., Chattanooga, Tenn.

HOISTS, PNEUMATIC

*Denver Rock Drill Mfg. Co., Denver, Colo.
Chicago Pneumatic Tool Co., New York.
Detroit Hoist & Machine Co., Detroit, Mich.
Hanna Eng. Works, Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Northern Engineering Works, Detroit, Mich.
Sullivan Mach'y Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

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*Denver Rock Drill Mfg. Co., Denver, Colo.
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Austin Machinery Corp'n, Toledo, O.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Works Sales Co., Duluth, Minn.
Flory Mfg. Co., S., Bangor, Pa.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Orr & Sembower, Reading, Pa.
Treadwell Eng. Co., Easton, Pa.

HOISTS FOR MOTOR TRUCKS

*Heil Co., The Milwaukee, Wis.
*Wood Hydr. Hoist & Body Co., Detroit, Mich.
Horizontal Hydr. Hoist Co., Detroit, Mich.
Perfection Hoist & Engine Co., Two Rivers, Wis.
Van Dorn Iron Wks., Cleveland, O.

HOLLOW TILE

Bannon Pipe Co., P., Louisville, Ky.
Dee Co., Wm. E., Chicago, Ill.
Delaware Clay Products Co., Pittsburgh, Pa.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Medal Paving Brick Co., Cleveland, Ohio.
Metropolitan Paving Brick Co., Canton, Ohio.
National Fireproofing Co., Pittsburgh, Pa.

HOPPERS, CONCRETE

*Littleford Bros., Cincinnati, O.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.
Weller Mfg. Co., Chicago, Ill.

HOSE, AIR

Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodyear Tire & Rubber Co., Akron, O.
Ingersoll-Rand Co., New York.
Penna Flexible Metallic Tubing Co., Phila., Pa.
Republic Rubber Co., Youngstown, O.
U. S. Rubber Co., New York

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*Goodrich Rubber Co., B. F., Akron, O.
Bi-Lateral Fire Hose Co., Chicago, Ill.
Fabric Fire Hose Co., New York.
Goodyear Tire & Rubber Co., Akron, Ohio.
U. S. Rubber Co., New York.

HOUSE NUMBERS

Hamilton Metal Prod. Co., Hamilton, O.
Niagara Metal Stamping Corp., Nia. Falls, N. Y.

HOUSES, PORTABLE. (See Buildings, Portable)

HYDRANTS, FIRE

*Ludlow Valve Mfg. Co., Troy, N. Y.
*Rensselaer Valve Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Mfg. Co., Waterford, N. Y.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Norwood Engineering Co., Florence, Mass.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

HYDRAULIC RAMS

Deming Co., Salem, O.
Rice Hydraulic Engine Co., New York
Seattle Machine Works, Seattle, Wash.

ICE-MAKING MACHINERY

Brunswick-Kroeschell Co., New Brunswick, N. J.
Carbondale Machine Co., Carbondale, Pa.
Frick Co., Inc., Waynesboro, Pa.
Triumph Ice Machine Co., Cincinnati, O.
Vilter Mfg. Co., Milwaukee, Wis.
Vogt Mach. Co., Henry, Louisville, Ky.
York Mfg. Co., York, Pa.

INCINERATORS, GARBAGE. (See Garbage Disposal)

INDICATOR POSTS. (See Valves)

INSPECTING LABORATORIES

*Conard & Busby, Burlington, N. J.
*Standard Testing Laboratories, Inc., New York.
Allentown Testing Laboratories, Allentown, Pa.
Gulick-Henderson Co., New York
Hunt & Co., Robert W., Chicago, Ill.
N. Y. Testing Laboratories, New York.
Pittsburgh Testing Laboratories, Pittsburgh, Pa.

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Ainsworth & Sons, Wm., Denver, Col.
Beckman Co., L., Toledo, Ohio
Berger & Sons, O. L., Boston, Mass.
Brandis & Sons Mfg. Co., Brooklyn, N. Y.

"Will soon pay for itself"

"I HAVE been grading roads that cost from Seventy-five Dollars to One Hundred Dollars per mile by contract, and with the Best 'Thirty' they have cost from Twenty Dollars to Twenty-five Dollars per mile in cost of labor, gas and oil. *You can readily see that it will soon pay for itself,*" a County Commissioner in Oklahoma writes.

Investigate the quality of work done and the low cost on other jobs where Best "Thirties" or "Sixties" were used. Write for a list of nearby owners.

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St. Louis, Mo.

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Dietzgen Co., Eugene, Chicago, Ill.
Gurley, W. & L. E., Troy, N. Y.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lietz Co., A., San Francisco, Cal.
Leupold & Voelpel, Portland, Ore.
Pfister, Wm. H., Cincinnati, O.
Ulmer, J. C., Co., Cleveland, Ohio.
Weber & Co., F., Philadelphia, Pa.
White Co., David, Milwaukee, Wis.
Wissler Instrument Co., St. Louis, Mo.

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(See Bridges and Buildings)

JACKS, LIFTING
*McKiernan-Terry Drill Co., New York.
Buda Company, Chicago, Ill.
Duff Mfg. Co., Pittsburgh, Pa.
Joyce-Cridland Co., Dayton, O.
Kalamazoo Railway Supply Co., Kalamazoo, Mich
Norton, Inc., A. O., Boston, Mass.
Rees Mfg. Co., Pittsburgh, Pa.
Templeton, Kenly & Co., Ltd., Chicago, Ill.
Watson-Stillman Company, New York.

JACKS, PIPE FORCING
*Clark Co., H. W., Matteon, Ill.
Duff Mfg. Co., Pittsburgh, Pa.

JAIL AND PRISON WORK
Barnum Iron Works, E. T., Detroit, Mich.
Pauly Jail Bldg. Co., St. Louis, Mo.
Stewart Iron Works Co., Cincinnati, Ohio.
Van Dorn Iron Works Co., Cleveland, O.

JOINTS, EXPANSION PAVING
(See Expansion Joint Material)

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

KETTLES, FOR ASPHALT AND TAR HEATING
*Barber Asphalt Co., Philadelphia, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Good Roads Machinery Co., Kennett Square, Pa.
*Kinney Mfg. Co., Boston, Mass.
*Littleford Bros., Cincinnati, O.
*Universal Road Machinery Co., Kingston, N. Y.
Acme Road Mach. Co., Frankfort, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.
Honhorst Co., Jos., Cincinnati, Ohio.
Macleod Co., Cincinnati, O.
Stuebner Iron Wks., G. L., L. I. City, N. Y.
Tarrant Mfg. Co., Saratoga Springs, N. Y.
Union Iron Wks., Hoboken, N. J.

LANTERNS, CONTRACTORS'
Adams & Westlake Co., Chicago, Ill.
Defiance Lantern & Stamping Co., Rochester, N.Y.
Dietz Co., R. E., New York.
Handlan, Buck Mfg. Co., St. Louis, Mo.

LATH, METAL
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Bostwick Steel Lath Co., Niles, O.
Consol. Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
General Fireproofing Co., Youngstown, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Northwestern Expanded Metal Co., Chicago, Ill.
Penn Metal Co., Boston, Mass.
Servicised Products Co., Chicago, Ill.
Sykes Metal Lath & Roofing Co., Niles, O.
Wickwire Spencer Steel Corp., New York.
Youngstown Pressed Steel Co., Warren, O.

LAWN MOWERS
Coldwell Lawn Mower Co., Newburgh, N. Y.
Gilson Mfg. Co., Port Washington, Wis.
Ideal Power Lawn Mower Co., Lansing, Mich.
Jacobsen Mfg. Co., Racine, Wis.
Penna. Lawn Mower Works, Philadelphia, Pa.
Philadelphia Lawn Mower Co., Philadelphia, Pa.
Townsend Co., S. P., Bloomfield, N. J.
Worthington Mower Co., Shawnee, Pa.

LEADITE
Leadite Co., The, Philadelphia, Pa.

LEAD-MELTING FURNACES
*Littleford Bros., Cincinnati, O.
Canton Firy & Machy. Co., Canton, O.
Chicago Flexible Shaft Co., Chicago, Ill.
Focht's Sons, Geo., Hoboken, N. J.
Hauck Mfg. Co., Brooklyn, N. Y.
Smith Mfg. Co., A. P., E. Orange, N. J.

LETTERS AND FIGURES, METAL
Niagara Metal Stamp. Corp., Niagara Falls, N. Y

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Carbic Mfg. Co., Duluth, Minn.
General Electric Co., Schenectady, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.
Macleod Co., Cincinnati, O.
Milburn Co., Alex., Baltimore, Md.
Prest-O-Lite Co., Inc., New York

LIGHTING STANDARDS. (See Street Lamp Posts)

LIQUID CHLORINE
Electro Bleaching Gas Co., New York.
Mathieson Alkali Works, Inc., New York.
Penna. Salt Mfg. Co., Philadelphia, Pa.

LOADERS, GRAVEL, WAGON, CAR, ETC.
*Atlas Engineering Co., Milwaukee, Wis.
*Haiss Mfg. Co., Geo., New York.
*Sauerman Bros., Chicago, Ill.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Machinery Corp'n, Toledo, O.
Bacon Co., Edw. R., San Francisco, Cal.
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
Bonney Supply Co., Inc., Rochester, N. Y.
Chain Belt Co., Milwaukee, Wis.
Conant Machine Co., Concord Jct., Mass.
Economy Excavator Co., Iowa Falls, Iowa.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Lyle Cnlv. & Rd. Equip. Co., Minneapolis, Minn
Nelson Iron Wks., Brooklyn, N. Y.
Portable Machy. Co., Passaic, N. J.
Sackett Screen & Chute Co., H. B., Chicago, Ill
Smith Co., T. L., Milwaukee, Wis.
Weller Mfg. Co., Chicago, Ill.

LOCK BAR STEEL PIPE
East Jersey Pipe Co., New York.

LOCKERS, STEEL
Durand Steel Locker Co., Chicago, Ill.
Hart & Hutchinson Co., New Britain, Conn.
Lyon Metallic Mfg. Co., Aurora, Ill.
Medart Mfg. Co., Fred., St. Louis, Mo.

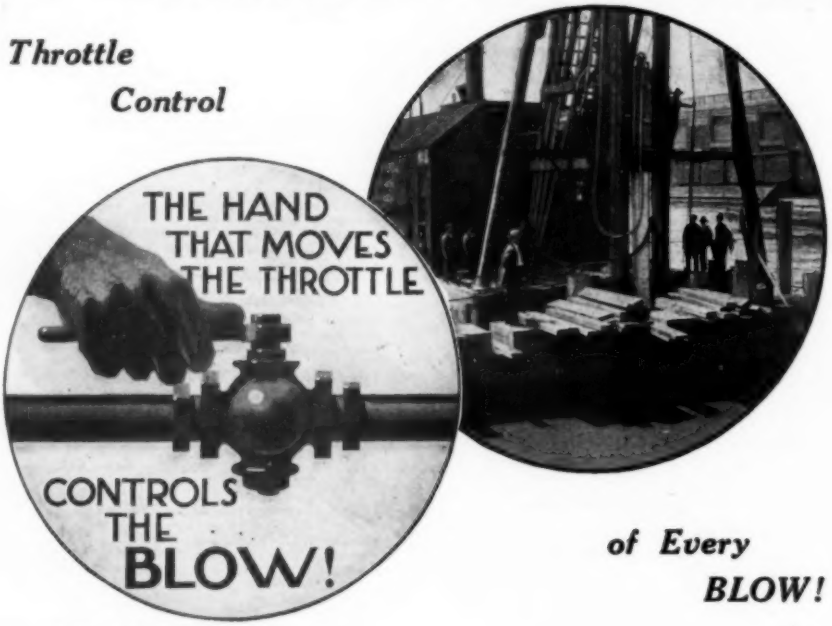
LOCOMOTIVES, FOR CONTRACTORS, ETC.
American Locomotive Co., New York, N. Y.
Baldwin Locomotive Works, The, Phila., Pa.
Brookville Track & Tractor Co., Brookville, Pa.
Burton Eng. & Mach. Co., Cincinnati, O.
Davenport Locomotive Works, Davenport, Ia.
Fate-Root-Heath Co., Plymouth, O.
Hadfield-Penfield Steel Co., Bucyrus, O.
Lima Locomotive Wks., Lima, O.
Industrial Equipment Co., Inc., Minster, O.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Porter Co., H. K., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa
Whitcomb Co., Geo. D., Rochelle, Ill.

LUMBER, HEAVY CONSTRUCTION
Brown Co., Portland, Me.
Crowell & Spencer Lumber Co., Long Leaf, La.
Exchange Sawmills Sales Co., Kansas City, Mo.
Great Southern Lumber Co., Bogalusa, La.
Industrial Lumber Co., Elizabeth, La.
Long Bell Lumber Co., Kansas City, Mo.
Sargent Lumber Co., Little Rock, Ark.
Sterner Co., Inc., E. J., New York
Weyerhaeuser Sales Co., Spokane, Wash.

LUMBER, STEEL
*Truscon Steel Co., Detroit, Mich.
Berger Mfg. Co., Canton, O.

For Concrete Pile Driving

Throttle Control



of Every BLOW!

You get it with

McKiernan-Terry Hammers

9-B and 11-B Double Acting

At last it is possible to use heavy pile hammers to drive concrete piles—or heavy timber piles—when prevailing conditions seem to indicate loading and jetting as the only method possible.

The throttle control of the blows of McKiernan-Terry 9-B and 11-B concrete Pile driving Hammers permits exact regulation of the velocity, energy and frequency of the blows!

The fact is, the throttle control made possible by these Hammers permits exact regulation of the blow for any size and type of concrete pile and soil resistance.

A touch of the operator's hand on the throttle, and the steam accelerated ram of these big hammers can be made to merely tap-tap on the pile head.

—or to deliver from 120 to 140 blows a minute using the entire force of the 1250 lb. and 3625 lb. rams.

Think this over. Your experience will tell you that throttle control of velocity, energy and frequency of ram blows is essential to meet varying conditions of driving concrete piles and heavy timber piling.

In McKiernan-Terry Double Acting pile hammers you get throttle control of every blow. Write for Bulletin 31 fully descriptive of these hammers.

McKIERNAN-TERRY DRILL COMPANY

Rock Drills Pile Hammers Lifting Jacks Mining and Quarrying Machinery

19 PARK ROW, NEW YORK **Works at Dover, N. J.**

Agencies in the Following Cities:

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Foreign Representatives: British Steel Piling Co., London, England.

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National Pressed Steel Co., Massillon, O.
Northwestern Exp. Metal Co., Chicago, Ill.

MANHOLE COVERS. (See "Castings, Street")

METAL LATH. (See "Lath")

METAL ROOFING (See "Roofing)

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*Clark Co., H. W., Mattoon, Ill.
*Ford Meter Box Co., Wabash, Ind.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Mueller Mfg. Co., H., Decatur, Ill.

METER COUPLINGS

*Clark Co., H. W., Mattoon, Ill.
*Ford Meter Box Co., Wabash, Ind.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Mueller Mfg. Co., H., Decatur, Ill.

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*Clark Co., H. W., Mattoon, Ill.
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*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
Buffalo Meter Co., Buffalo, N. Y.
Mueller Mfg. Co., H., Decatur, Ill.
National Meter Co., New York.

METERS, ELECTRIC (WATTHOUR)

Duncan Elec. Mfg. Co., LaFayette, Ind.
General Electric Co., Schenectady, N. Y.
Sangamo Electric Co., Springfield, Ill.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

METERS, GAS

*Pittsburgh Meter Co., E. Pittsburgh, Pa.
American Meter Co., New York
Builders Iron Fdry., Providence, R. I.

METERS, WATER

*Badger Meter Mfg. Co., Milwaukee, Wis.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Buffalo Meter Co., Buffalo, N. Y.
Federal Meter Co., Brooklyn, N. Y.
Gamon Meter Co., Newark, N. J.
Hersey Mfg. Co., Boston, Mass.
National Meter Co., New York.
Thomson Meter Co., Brooklyn, N. Y.
Worthington Pump & Mchy. Corp., New York.

METERS, WATER (VENTURI TYPE)

Builders Iron Foundry, Providence, R. I.
Simplex Valve & Meter Co., Philadelphia, Pa.

MIXERS, CONCRETE. (See Concrete Mixers.)

MIXERS, GROUT

*American Cement Mchy. Co., Inc., Keokuk, Ia.
Kent Machine Co., Kent, O.
Lakewood Engineering Co., Cleveland, O.
Union Iron Works, Inc., Hoboken, N. J.

MIXERS, HOT

*Barber Asphalt Co., Philadelphia, Pa.
*Koehring Co., Milwaukee, Wis.
Austin Machinery Corp'n, Toledo, O.
Kent Machine Co., Kent, O.

MIXERS, MORTAR

*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Austin Machinery Corp'n, Toledo, O.
Blaw-Knox Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Construction Machinery Co., Waterloo, Ia.
Federal Motor Truck Co., Detroit, Mich.
Kent Machine Co., Kent, O.
Knickerbocker Co., Jackson, Mich.
Lansing Co., Lansing, Mich.
Lakewood Engineering Co., Cleveland, Ohio.
Marsh-Capron Co., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.

MOTORCYCLES

Ace Motor Corp., Philadelphia, Pa.
Cleveland Motorcycle Co., Cleveland, Ohio.
Excelsior Motor Mfg. & Supply Co., Chicago, Ill.
Harley-Davidson Motor Co., Milwaukee, Wis.
Hendee Mfg. Co., Springfield, Mass.

MOTORS, ELECTRIC

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Elec. Co., Boston, Mass.
Lincoln Elec. Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

MOTORS, GASOLINE

Buda Co., Harvey, Ill.
Continental Motors Corp., Detroit, Mich.
Herschell-Spillman Co., No. Tonawanda, N. Y.
Hinkley Motors, Inc., Detroit, Mich.
Waukesha Motor Co., Waukesha, Wis.
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

MOTOR TRUCKS

*Garford Motor Truck Co., Lima, O.
*General Motors Truck Co., Pontiac, Mich.
*International Motor Co., New York.
Acme Motor Truck Co., Cadillac, Mich.
Atterbury Motor Car Co., Buffalo, N. Y.
Autocar Co., Ardmore, Pa.
Bessemer Motor Truck Co., Grove City, Pa.
Brockway Motor Truck Co., Cortland, N. Y.
Clydesdale Motor Truck Co., Clyde, O.
Corbitt Motor Truck Co., Henderson, No. Car.
Denby Motor Truck Co., Detroit, Mich
Diamond T. Motor Car Co., Chicago, Ill.
Duplex Truck Co., Lansing, Mich.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Gramm Bernstein Motor Truck Co., Lima, O.
Indiana Truck Corp'n., Marion, Ind.
International Harvester Co., Chicago, Ill.
Kelly Springfield Motor Truck Co., Springfield, O.
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Tr. Co., Binghamton, N.Y.
Nash Motors Co., Kenosha, Wis.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Rowe Motor Mfg. Co., Lancaster, Pa.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Corp'n., Buffalo, N. Y.
Tiffin Wagon Co., Tiffin, O.
Titan Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
Ward LaFrance Truck Co., Elmira, N. Y.
Wilson Co., J. C., Detroit, Mich.
White Co., Cleveland, Ohio.

MOULDS, CONCRETE

Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.

NUMBERS, HOUSE (See "House Numbers")

OAKUM

Wall Rope Works, Beverly, N .J.

OILS, ROAD

*Barber Asphalt Co., Philadelphia, Pa.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Company, New York.
Atlantic Refining & Asphalt Corp'n, Philadelphia
Barrett Co., New York.
Headley Good Roads Co., Philadelphia, Pa
Pierce Oil Corp., New York.
Sinclair Refining Co., Chicago, Ill.
Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.) Newark, N. J.
U. S. Asphalt Refining Co., New York.

Stanolind Asphalt at Topeka, Kans.

This Letter Helps You

FOR your benefit, the men who have actually used Stanolind Paving Asphalt are willing to tell you of its many good qualities. They know that the construction and maintenance of the roads and streets in your community is a problem which you can solve best by building pavements which will stand well the destructive truck and automobile traffic of today.

Therefore, letters such as the one reproduced above should be of great help to you, as they offer actual proof of the long life and low maintenance cost of roads constructed with Stanolind Paving Asphalt.

Although both roads which Mr. Rodgers mentions, are subjected to heavy, continuous traffic, they still are in as good condition as the first year they were laid, as is evidenced by the photographs.

To you, one of the most important factors about a Stanolind Asphalt road is the low maintenance cost. If breaks do occur, they are easily repaired by the ordinary working force. The new material adheres readily to the old, leaving no cracks or breaks which water or frost can enter. It is not necessary to tear up the pavement, nor to stop traffic on the road. Therefore, the breaks can be repaired as they appear.

Your experience with Stanolind Paving Asphalt will be identical with that of the other users, all of whom agree that the low initial cost of laying, the low maintenance cost and long life, make it the ideal road building material.

If you have not received your copy of our booklet telling the latest methods of constructing and maintaining asphalt pavements, we suggest that you write us at once. It will be a valuable addition to your business library. Use your official stationery, please.

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Leadite Co., The, Philadelphia, Pa.
United Lead Company, New York.

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Mott Iron Wks., J. L., New York.
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Carter Bloxonend Flooring Co., Kansas City, Mo.
Compressed Wood Preserving Co., Cincinnati, O.
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Jennison-Wright Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Wyckoff Pipe & Creosoting Co., New York.

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Barr Clay Co., Streator, Ill.
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Burton Townsend Co., Zanesville, O.
Cleveland Brick & Clay Co., Cleveland, O.
Clydesdale Brick & Stone Co., Pittsburgh, Pa.
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Corry Brick & Tile Co., Corry, Pa.
Flint Brick Co., Des Moines, Ia.
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Georgia Brick & Tile Co., Adairsville, Ga.
Hammond Fire Brick Co., Fairmont, W. Va.
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Moberly Paving Brick Co., Moberly, Mo.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Kas.
Poston Paving Brick Co., Crawfordsville, Ind.
Purington Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Springfield Paving Brick Co., Springfield, Ill.
Sterling Brick Co., Olean, N. Y.
Streator Clay Mfg. Co., Streator, Ill.
Thornton Fire Brick Co., Clarksburg, W. Va.
Taurber Brick Co., Taurber, Texas.
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Trinidad Brick & Tile Co., Trinidad, Colo.
Veedersburg Paver Co., Veedersburg, Ind.
Western Clay Mfg. Co., Helena, Mont.
Westport Paving Brick Co., Westport, Md.

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International Steel Tie Co., Cleveand, O.

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*Connery & Co., Inc., Philadelphia, Pa.
*Littleford Bros. Co., Cincinnati, O.
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Cummer & Sons Co., F. D., Cleveland, O.
Union Iron Works, Hoboken, N. J.

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Hendrick Mfg. Co., Carbondale, Pa.

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Iron City Tool Works, Pittsburgh, Pa.
Klein-Logan Co., Pittsburgh, Pa.
Verona Tool Works, Verona, Pa.
Warren Tool & Forge Co., Warren, O.
Warwood Tool Co., Wheeling, W. Va.
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Industrial Works, Bay City, Mich.
Lidgerwood Manufacturing Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
McMyler Interstate Co., Cleveland, O.
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Industrial Works, Bay City, Mich.
National Hoisting Eng. Co., Harrison, N. J.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Chicago, Ill.

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Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

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American Cast Iron Pipe Co., Birmingham, Ala.
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Donaldson Iron Co., Emaus, Pa.
Fox & Co., John, New York.
Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
National Cast Iron Pipe Co., Birmingham, Ala.
Warren Fdry. & Machine Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

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PIPE, LEAD
United Lead Company, New York

PIPE, REINFORCED CONCRETE
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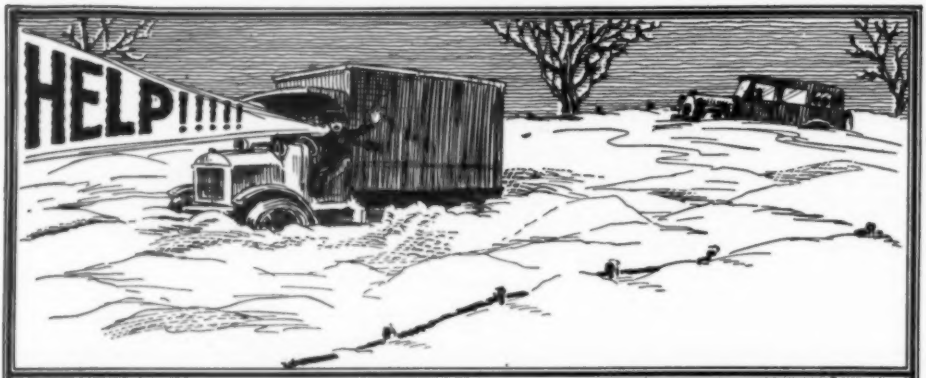

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Redwood Mfrs. Co., San Francisco, Cal.
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Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
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Warren Fdry. & Mach. Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

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Mott Iron Wks., J. L., New York
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United Brass Mfg. Co., Cleveland, O.
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Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York.
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
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Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
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Weinman Pump Mfg. Co., Columbus, O.
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Aurora Pump & Mfg. Co., Aurora, Ill.
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Cameron Steam Pump Works, A. S., New York.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Domestic Engine & Pump Co., Shippensburg, Pa.
Erie Pump & Engine Works, Medina, N. Y.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
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Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
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United Iron Works, Kansas City, Mo.
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Yeomans Bros. Co., Chicago, Ill.

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Aurora Pump & Mfg. Co., Aurora, Ill.
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Carter Co., Ralph B., New York.
C. H. & E. Mfg. Co., Milwaukee, Wis.
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Deming Co., Salem, Ohio.
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Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
LeCourtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., Ashland, O.
Northern Fire App. Co., Minneapolis, Minn.
Novo Engine Co., Lansing, Mich.
Pulsometer Steam Pump Co., New York.
Schramm, Inc., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
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*Clark Co., H. W., Mattoon, Ill.
*Keystone Driller Co., Beaver Falls, Pa.
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Cameron Steam Pump Works, A. S., New York.
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Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Layne & Bowler Co., Memphis, Tenn.
McDonald Mfg. Co., A. Y., Dubuque, Ia.
Midwest Engine Co., Indianapolis, Ind.
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*Aldrich Pump Co., Allentown, Pa.
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Aurora Pump & Mfg. Co., Aurora, Ill.
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Cameron Steam Pump Wks., A. S., New York.
Erie Pump & Engine Co., Medina, N. Y.
Morris Machine Works, Baldwinsville, N. Y.
Rumsey Pump Co., Ltd., Seneca Falls, N. Y.
Wood & Co., R. D., Philadelphia, Pa.
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American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
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Le-Courtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Myers & Bro. Co., F. E., Ashland, O.
Nordberg Mfg. Co., Milwaukee, Wis.
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Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Eng. Works, Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Watson-Stillman Co., New York.

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Dunbar Drop Forge Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

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*Austin-Western Road Mchy. Co., Chicago, Ill.
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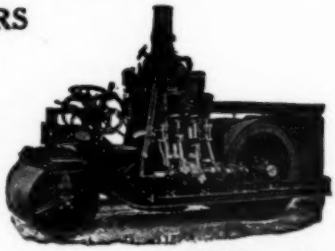

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Pennsylvania Cement

:-: QUALITY :-: SERVICE :-:

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*Kinney Mfg. Co., Boston, Mass.
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Etnyre & Co., E. D., Oregon, Ill.
White Co., Cleveland, O.

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*Buffalo Springfield Roller Co., Springfield, O.
*Erie Machine Shops, Erie, Pa.
*Galion Iron Works & Mfg. Co., Galion, Ohio.
*Good Roads Mach. Co., Kennett Square, Pa.
Avery Co., Peoria, Ill.
Case Threshing Machine Co., J. I., Racine, Wis.
Huber Mfg. Co., Marion, O.

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*Baker Mfg. Co., Springfield, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co, Springfield, O.
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*Holt Mfg. Co., Peoria, Ill.
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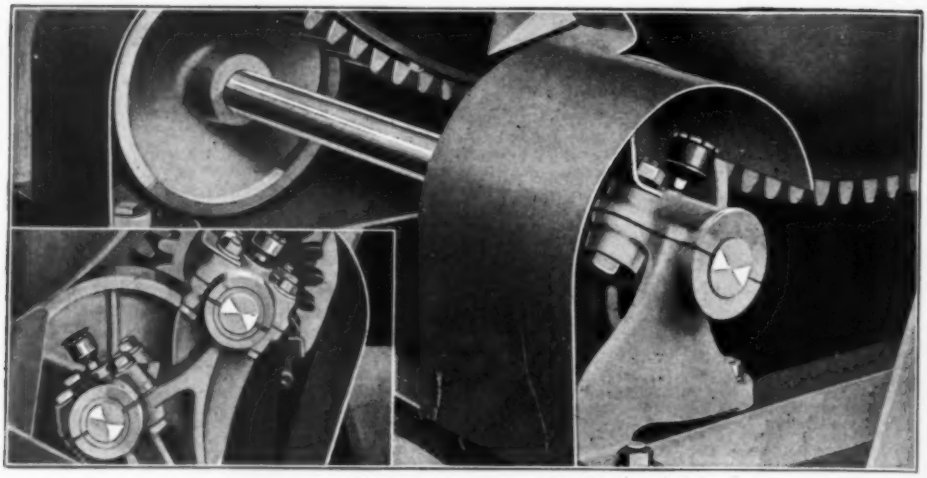
*Good Roads Mach. Co., Kennett Square, Pa.



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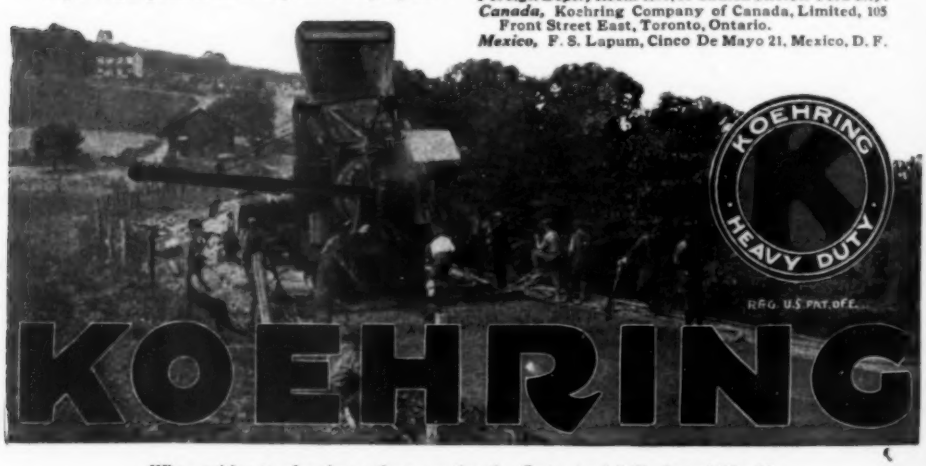

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Marion Steam Shovel Co., Marion, O.
Thew Shovel Co., Lorain, O.

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TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

TAMPING MACHINES

*Pawling & Harnischfeger Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Ia.
Ingersoll-Rand Co., New York

TANKS, AIR COMPRESSOR

*Connery & Co., Inc., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Abendroth & Root Mfg. Co., New York.
Biggs Boiler Wks., Akron, O.
Graver Corporation, E. Chicago, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Chicago Bridge & Iron Works, Chicago, Ill.
Ingersoll-Rand Co., New York.
Lancaster Iron Wks., Lancaster, Pa.
National Tube Co., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.
Westinghouse Tract. Brake Co., Wilmerding, Pa.
Worthington Pump & Machy. Corp., New York.

TANKS, STEEL

*Connery & Co., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Avery Co., Peoria, Ill.
Biggs Boiler Wks., Akron, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Case Threshing Mach. Co., J. I., Racine, Wis.
Caldwell Co., W. E., Louisville, Ky.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Dover Boiler Wks., New York.
Farrell Mfg. Co., Joliet, Ill.
Fouts Co., C. C., Middletown, O.
Graver Corporation, E. Chicago, Ind.
Hardesty Mfg. Co., R., Denver, Col.
Hendrick Mfg. Co., Carbondale, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

TANKS, WOOD

Caldwell Co., W. E., Louisville, Ky.
Davis & Son, G. M., Palatka, Fla.
Eagle Tank Co., Chicago, Ill.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
National Tank & Pipe Co., Portland, Ore.
Pacific Tank & Pipe Co., San Francisco, Cal.
Redwood Manufacturers Co., San Francisco, Calif.
Stearns Lumber Co., A. T., Boston, Mass.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago, Ill.

TANK WAGONS

*Heil Co., Milwaukee, Wis.
*International Motor Co., New York.
Acme Road Mach. Co., Frankfort, N. Y.
Avery Co., Peoria, Ill.
Case Threshing Mach. Co., J. I., Racine, Wis.

TAPES, STEEL AND METALLIC

*Lufkin Rule Co., Saginaw, Mich.
Dietzgen Co., Eugene, New York.
Keuffel & Esser Co., Hoboken, N. J.
Starrett, L. S., Athol, Mass.

TAPPING MACHINES

Hays Mfg. Co., Erie, Pa.
Mueller Mfg. Co., H., Decatur, Ill.
Smith Mfg. Co., A. P., E. Orange, N. J.

TAR

American Tar Products Co., Chicago, Ill.
Barrett Co., New York.

TAR KETTLES. (See Kettles)

TIES, STEEL

*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.

TIMBER CLAMPS

Pyle-Rogers Corp., New York.

TIRES, RUBBER. (For Motor Trucks.)

*Goodrich Rubber Co., Akron, O.
Firestone Tire & Rubber Co., Akron, O.
Fisk Tire Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Kelly Springfield Tire Co., New York.
Republic Rubber Co., Youngstown, O.
U. S. Tire Co., New York.

TOOL HOUSES, PORTABLE STEEL

*Littleford Bros., Cincinnati, O.

TOWERS (See Standpipe Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE

*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Atlas Car & Mfg. Co., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Fdry. & Mfg. Co., Columbus, O.
Easton Car & Constn. Co., New York.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Lakewood Engineering Co., Cleveland, O.

TRACTORS

*Best Tractor Co., C. L., San Leandro, Cal.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
Advance-Rumely Thresher Co., Laporte, Ind.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Avery Co., Peoria, Ill.
Barrett-Cravens Co., Chicago, Ill.
Bates Machine & Tractor Co., Joliet, Ill.
Case Threshing Machine Co., J. I., Racine, Wis.
Clark Tractor Co., Chicago, Ill.
Cleveland Tractor Co., Cleveland, O.
Dayton-Dowd Co., Quincy, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Hart-Parr Co., Charles City, Iowa.
Huber Mfg. Co., Marion, O.
International Harvester Co., Chicago, Ill.
J. T. Tractor Co., Cleveland, O.
Little Giant Co., Mankato, Minn.
Moline Plow Co., Rock Island, Ill.
Monarch Tractors, Inc., Watertown, Wis.
Oliver Tractor Co., Knoxville, Tenn.
Shaw-Enochs Tractor Co., Minneapolis, Minn.
Tioga Tractor Co., Baltimore, Md.
Twin City Co., Minneapolis, Minn.
White Company, The, Cleveland, O.

TRAFFIC PAINT

Hoosier Paint Wks., Ft. Wayne, Ind.
Sewall Paint & Glass Co., Kansas City, Mo.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

TRAFFIC SIGNS. (See "Signs, Traffic")

TRAILERS FOR TRUCKS AND TRACTORS

Arcadia Trailer Corp., Newark, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Highway Trailer Co., Edgerton, Wis.
La Plant-Choate Mfg. Co., Cedar Rapids, Ia.
Lee Trailer & Body Co., Chicago, Ill.
Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n., Canastota, N. Y.
Whitehead & Kales Co., Detroit, Mich.

TRAILERS, INDUSTRIAL

Chase Fdry. & Mfg. Co., Columbus, O.
Electric Wheel Co., Quincy, Ill.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.

TRAMWAYS, AERIAL WIRE ROPE

Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.

TRANSFORMERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

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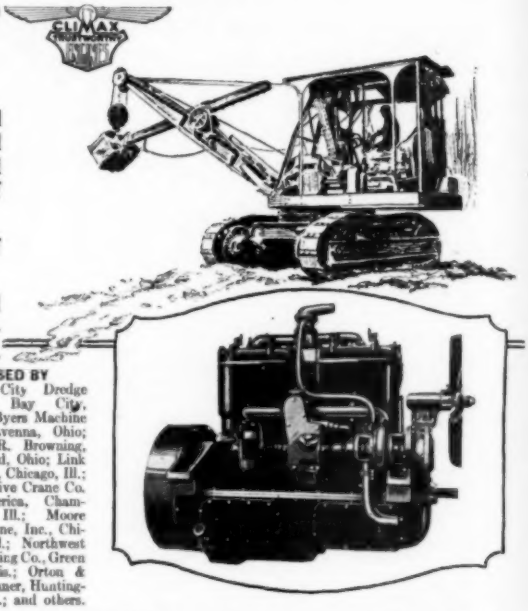

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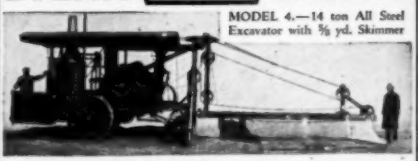
MODEL 4.—14 ton All Steel Excavator with ⅝ yd. Skimmer



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The heavy Keystone Skimmer Bucket, ⅝ yd. capacity, has a horizontal crowd of 14 feet and fills itself at one effort on a six inch cut. It loads a standard six foot, freshly graded road of sharp, dry gravel, earth or sand—solid excavation, paving blocks, concrete and asphalt—in keystone style.

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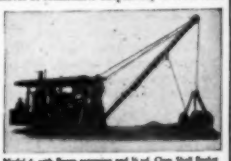

Model 4, with Boom extension and ½ yd. Clam Shell Bucket

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Keystone stands on the solid. No cribbing needed, no danger from cave-in, of machine sliding into excavation. Any width or depth to 20 feet. There is 4 feet of water in this 12 foot ditch. The Keystone is adapted for hard going among roots, boulders, etc., and cleaning out blasted rock.

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Dodge Mfg. Corp'n, Mishawaka, Ind.
General Electric Co., Schenectady, N. Y.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
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TRASH CANS. (See Cans)

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American Mason Safety Tread Co., Lowell, Mass.
Concrete Steel Co., New York.
Hendrick Mfg. Co., Carbondale, Pa.
Norton Co., Worcester, Mass.

TRENCH BRACES. (See Braces, Trench)

TRENCH EXCAVATORS, (see Excavators, Ditch & Trench)

TRENCH PUMPS. (See Pumps, Contractors')

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

TURNTABLES FOR MOTOR TRUCKS
Blaw-Knox Co., Pittsburgh, Pa.
Champion Eng. Co., Kenton, O.
The Hug Co., Highland, Ill.
Western Structural Co., Moline, Ill.

USED MACHINERY
(See Contractors' Used Equipment.)

VALVE CONTROL APPARATUS, ELECTRIC
Payne Dean, Ltd., New York.

VALVES, GATE AND INDICATOR POSTS
*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Columbian Iron Wks., Chattanooga, Tenn.
Crane Company, Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Reading Steel Casting Co., Inc., Bridgeport, Conn.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

VALVE BOXES AND HOUSINGS
*Central Foundry Co., New York.
*Clark Co., H. W., Mattoon, Ill.
*Ludlow Valve Co., Troy, N. Y.
*U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Mueller Mfg. Co., H., Decatur, Ill.
Pratt & Cady Co., Inc., Hartford, Conn.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

VENTILATORS
American Blower Co., Detroit, Mich.
Edwards Mfg. Co., Cincinnati, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WAGONS. (See Dump Carts and Wagons.)

WAGON BODIES. (See Dump Bodies)

WAGON LOADERS. (See Loaders, Gravel and Wagon)

WALLBOARD
*Carey Co., Philip, Cincinnati, Ohio.
Beaver Board Companies, Buffalo, N. Y.
Bird & Son, inc., E. Walpole, Mass.
Cornell Wood Products Co., Chicago, Ill.
Haverhill Box Board Co., Haverhill, Mass.
MacAndrews & Forbes Co., New York, N. Y.
Plastergon Wall Board Co., Buffalo, N. Y.
United States Gypsum Co., Chicago, Ill.
Upson Co., The, Lockport, N. Y.
Waldorf Paper Products Co., St. Paul, Minn.

WALL TIES
Concrete Steel Co., New York, N. Y.
Consolidated Expanded Metal Co., Braddock, Pa.
Berger Mfg. Co., Canton, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.

WATER MAIN CLEANING
*National Water Main Cleaning Co., New York.

WATER MAIN TAPPING MACHINES
Mueller Mfg. Co., H., Decatur, Ill.
Smith Mfg. Co., A. P., East Orange, N. J.

WATER METERS. (See Meters, Water.)

WATERPROOFING COMPOUNDS AND MATERIAL
*Barber Asphalt Co., Philadelphia, Pa.
*Carey Co., Philip, Cincinnati, Ohio.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Company, New York.
Anti-Hydro Waterproofing Co., Newark, N. J.
Atlantic Refining & Asphalt Corp., Phil'a, Pa.
Barrett Company, New York.
General Fireproofing Co., Youngstown, O.
Master Builders' Co., Cleveland, O.
Minwax Co., The, New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
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Servicised Products Co., Chicago, Ill.
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Tock Brothers, New York.
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Electro Bleaching Gas Co., New York.
Mathieson Alkali Works, Inc., New York.
Penna. Salt Mfg. Co., Philadelphia, Pa.
R. U. V. Company, New York.

WATER REGULATORS
*Union Water Meter Co., Worcester, Mass.
Mueller Mfg. Co., Decatur, Ill.
Pacific Flush Tank Co., Chicago, Ill.

WATER SOFTENERS
American Water Softener Co., Philadelphia, Pa.
Graver Corporation, F., Chicago, Ind.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewell Filtr. Co., Nutley, N. J.
Permutit Company, New York
Roberts Filter Mfg. Co., Darby, Pa.
Scaife & Sons, W. B., Pittsburgh, Pa.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

WATER WASTE DETECTION
*Clark & Co., H. W., Mattoon, Ill.
*Pitometer Co., New York
Simplex Valve & Meter Co., Philadelphia, Pa.

WATER WHEELS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Leffel & Co., Jas., Springfield, O.
Pelton Water Wheel Co., San Francisco, Cal.
Smith Company, S. Morgan, York, Pa.

WATER WORKS PUMPS (See "Pumps, Centrifugal" and "Pumps, Deep Well")

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Lincoln Electric Co., Cleveland, O.

Standardized parts keep "Sterlings" cheapest

The mere matter of a shoe on the leg simply means you wear the shoe and not the leg.

This attention to details means a great deal to you in saving of repair costs and in added efficiency.

The handle clamps do away with bolt holes at the point of most strain —Thus you save handle breakage.

These improvements in construction add but little to the cost, but it puts Sterling barrows on a standard of quality.

Self-lubricating wheel bearings do away with the oil can and reduce the effort of wheeling—Ask your foreman

The longer the service the better "Sterlings" show by comparison because they are made right in every part.

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Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

WELL SCREENS

Cook, Inc., A. D., Lawrenceburg, Ind.
Johnson, Edw. E., Inc., St. Paul, Minn.

WELL-DRILLING AND BLAST HOLE MACHINES

*Keystone Driller Co., Beaver Falls, Pa.
American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Iowa.
Leidecker Tool Co., Marietta, Ohio.
Loomis Machine Co., Tiffin, Ohio.
Sanderson Cyclone Drill Co., Orrville, Ohio.
Sparta Iron Wks. Co., Sparta, Wis.
Star Drilling Machine Co., Akron, O.

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*Puffer-Hubbard Mfg. Co., Minneapolis, Minn.
*Sterling Wheelbarrow Co., Milwaukee, Wis.
Akron Barrow Co., Cleveland, O.
Jackson Mfg. Co., Harrisburg, Pa.
Lansing Co., Lansing, Mich.
Sidney Steel Scraper Co., Sidney, O.
Steubner Iron Wks., G. L., L. I. City, N. Y.
Toledo Wheelbarrow Co., Toledo, O.

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Chisholm-Moore Mfg. Co., Cleveland, O.
Clyde Iron Wks., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.

WINDOW FRAMES AND SASH. (Metallic.)

*Truscon Steel Co., Youngstown, O.
Bayley Co., Wm., Springfield, O.
Detroit Steel Products Co., Detroit, Mich.
Friedrich Co., E. H., Holyoke, Mass.
Lupton's Sons Co., David, Philadelphia, Pa.
McFarland Co., J. C., La Porte, Ind.
Penn Metal Co., Boston, Mass.
Sykes Co., Chicago, Ill.

WIRE AND CABLE

American Steel & Wire Co., Chicago, Ill.
Copper Clad Steel Co., Rankin, Pa.
General Electric Co., Schenectady, N. Y.
Habirshaw Elec. Cable Co., Inc., N. Y.
Hazard Mfg. Co., Wilkesbarre, Pa.
Macwhyte Co., Kenosha, Wis.
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Okonite Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Safety Ins. Wire & Cable Co., New York.
Simplex Wire & Cable Co., Boston, Mass.
Standard Underground Cable Co., Pittsburgh, Pa.
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Youngstown Sheet & Tube Co., Youngstown, O.

WIRE ROPE. **(See Rope, Wire.)**

WOOD BLOCKS **(See Paving Blocks)**

WOODWORKING MACHINES

*Ransome Concrete Mach. Co., Dunellen, N. J.
Fairbanks, Morse & Co., Chicago, Ill.

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Republic Creosoting Co., Indianapolis, Ind.
Truscon Laboratories, Detroit, Mich.

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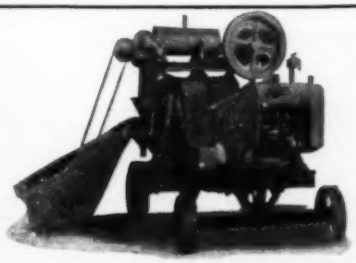

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120 to 150 Cu. Yds. in 10 hours with an Atlas one bag Mixer.

Atlas Mixers are of sturdy dependable construction, and the 7-S is regularly equipped with multiple cylinder LeRoi Engine, giving excess power.

We build 3½ ft., ½ bag, 1 bag and 2 bag Mixers.

Dealers write for agency proposition.

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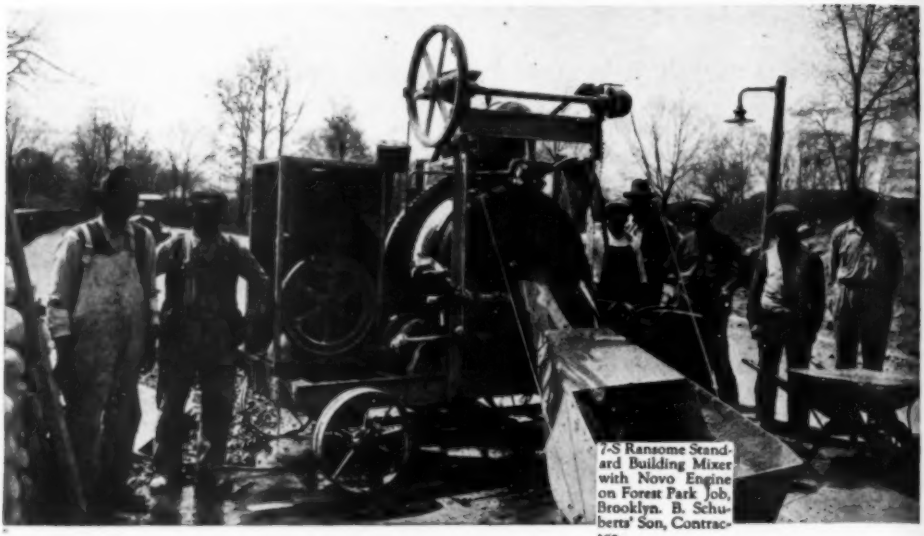

7-S Ransome Standard Building Mixer with Novo Engine on Forest Park Job, Brooklyn. B. Schuberts' Son, Contractor

just ask 'em-

The bonny boys in old shirts and grimy headpieces know what's what about a concrete mixer. They ought to—*they live with it.*

Ask them the name of the mixer that gives the least trouble and turns out a *good mix* in the shortest time. Five to one they'll say Ransome—just as the boss will in answer to the same question.

Benjamin Schubert sums up the opinion of his men when he says, "I can honestly say that I am more than pleased with the performance of that mixer (the 7-S Ransome pictured above) in every way.

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Manufacturers of Mixers, Pavers, Pneumatic Mixers, Chuting Plants, Hoist Buckets, Bins, Cars, Carts, etc.

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Without obligation on my part, please send me information on:—
Building Mixers, sizes 4-S__; 7-S__; 10-S__; 14-S__; 21-S__; 28-S__; 56-S__, Driven by Belt__, Steam__, Gasoline__, Electric__
Paving Mixers, sizes 7-E__; 10-E__; 14-E__; 21-E__. Concrete Chuting Plant for structure__ft. long by__ft. wide by__ft. high.

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An Investigation in the Use of Calcium Chloride as a Curing Agent and Accelerator of Concrete

By H. F. Clemmer and Fred Burggraf

Engineer of Materials and Assistant Engineer of Materials, respectively, Illinois Highway Division

OVER 500 concrete slabs, 8 by 12 by 30 inches, were subjected to various surface treatments and tested for transverse strength by the Illinois Division of Highways. Cylinders, 6 by 12 inches, were also made to serve as a check on the compressive strength of the concrete making up the transverse specimens. The same volumetric mix of 1:2:3½, which is the standard adopted by the state of Illinois for concrete highways, was used in all specimens. Portland cement was used in all cases, and the aggregates consisted of sand and washed limestone which passed all state specifications.

As Illinois was interested primarily in securing a satisfactory curing at the end of 28 days or earlier, more emphasis was placed on these short-time tests than on 60- or 90-day specimens. For the purpose of checking the strength of the untreated specimens at the older ages, a number of 60- and 90-day specimens were made. At the time of testing, the specimens were removed from their forms and broken in a universal testing machine with the treated side in tension. The modulus of rupture was then computed and the variation in strengths considered as a measure of the completeness of curing. Inasmuch as the same operators made all of the specimens, and the consistency and gradation of aggregates was the same in all cases, it was fairly well established that a uniform concrete was present. Because of the magnitude of the investigation, it was necessary to divide the tests into eight series, some of which were check tests and some of

CURING CONCRETE WITH WATER COSTLY

In 1921 the Illinois Division of Highways began an extensive investigation in the use of calcium chloride both as a curing agent and as an accelerator in the setting of concrete. The need for a method of curing concrete pavements without the use of water became evident when a number of road builders adopted the central mixing plant method of construction. The cost of transporting water, either by tank or pipe line, for the purpose of curing alone proved excessive. Curing under these conditions was extremely costly in many cases. The absence of sufficient water in certain localities also created a demand for a new method of curing. At the same time, the importance of developing a satisfactory and safe means of securing a quick set and early strength was appreciated, when it was considered that at certain times it is necessary to place a small stretch of pavement in low temperatures or open a section of road in less time than is usually the custom. This paper reviews the investigations conducted by this department, the results of which have led to the adoption of both the external and the internal usage of calcium chloride in concrete highway construction.

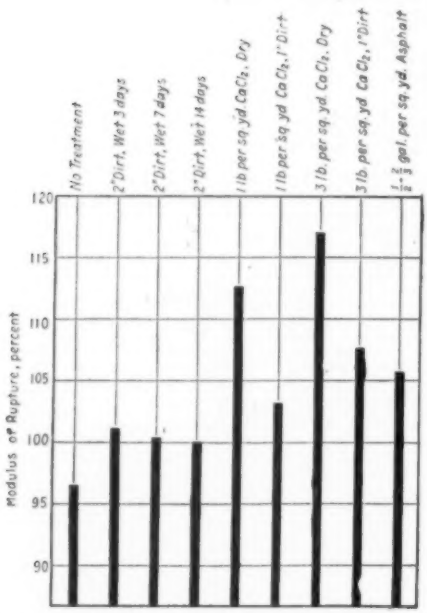


FIG. 1. COMPARISON OF EXTERNAL TREATMENTS

The strength of specimens secured with 2 inches of dirt, wet 14 days, is taken as 100 per cent. Each result is the average of eleven specimens at 28 days

which differed only in the method of applying the curing materials or placing the specimens. The slight differences in the method of treatment in each series failed to show any great variation in results, and for this reason the eight series are reported as condensed into but three, which are taken up individually.

Series 1.—This series included 260 specimens, 100 of which were poured in holes in the ground having side boards only, 60 in oiled wood forms in the basement of the laboratory, and the remaining 100 in concrete forms. These forms consisted of 1:4:5 concrete with walls 3 inches thick and 8 inches deep. They were allowed to set up for 48 hours before the curing specimens were poured. The object in using these forms was to provide a condition of curing concrete against concrete as similar as possible to a portion of a slab within a pavement.

Care was taken to cover all specimens with a canvas immediately after they were finished, to provide protection against hot, drying sunlight. All specimens were finished with a trowel and were given their curing treatments the day following.

The specimens in this series received the following treatments: 2 inches of dirt wet 3 days; 2 inches of dirt wet 7 days; 2 inches of dirt wet 14 days; 1 pound per square yard of calcium chloride with 1 inch of dirt; 3 pounds per square yard of calcium chloride; 3 pounds per square yard of calcium chloride with 1 inch of dirt; ½ to ⅔ gallon of asphalt per square yard.

Series 2.—The specimens in this series were poured both in oiled wood forms and in concrete forms. The effect of an oiled subgrade, as well as the use of magnesium calcium chloride and sodium silicate as curing agents, was investigated in this series. The length of time over which calcium chloride must remain on the specimens in order to cure them properly was also investigated in this series. This latter test was prompted by the question regarding the necessity of making a second application of calcium chloride if the original was washed from the pavement by a rain.

The specimens in this series were treated as follows: 3 pounds per square yard of calcium chloride after 10 hours; 3 pounds per square yard of calcium chloride after 24 hours; 3 pounds per square yard of calcium chloride after 10 hours, washed off 12 hours later; 3 pounds per square yard of magnesium calcium chloride after 10 hours; 3 pounds per square yard of magnesium calcium chloride after 24 hours; 1/5 normal solution of sodium silicate after 10 hours; 1/5 normal solution of sodium silicate after 24 hours; 2 inches of dirt wet 7 days; 2 inches of dirt wet 14 days; 2 inches of dirt wet 7 days (subgrade oiled). These specimens were tested at the age of 14 and 28 days.

Series 3.—The series consisted of specimens which were cured with various forms of calcium chloride. It was first desired to compare the results obtained with dry calcium chloride

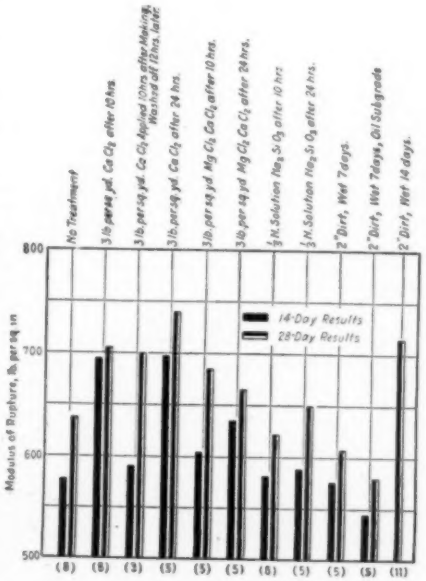

No Treatment
3 lb. per sq. yd. Ca Cl2 after 10 hrs.
3 lb. per sq. yd. Ca Cl2 Applied 10 hrs. after Making, Washed off 12 hrs. later
3 lb. per sq. yd. Ca Cl2 after 24 hrs.
3 lb. per sq. yd. Mg Cl2 Ca Cl2 after 10 hrs.
3 lb. per sq. yd. Mg Cl2 Ca Cl2 after 24 hrs.
⅕ N. Solution Na2 Si O3 after 10 hrs.
⅕ N. Solution Na2 Si O3 after 24 hrs.
2" Dirt, Wet 7 days.
2" Dirt, Wet 7 days, Oil Subgrade
2" Dirt, Wet 14 days.
14-Day Results
28-Day Results
Modulus of Rupture, lb. per sq. in.
800
700
600
500
(8) (8) (3) (3) (5) (5) (5) (5) (5) (5) (11)

FIG. 2. TEST SHOWING RESULTS OF VARIOUS CHLORINE TREATMENTS

Figures in parenthesis indicate number of specimens broken at each age

with those obtained with calcium chloride in solution, with the thought in mind that a more even distribution of the material could be made if in solution. The second half of this series was devoted to the comparison of the results obtained by the use of flake calcium chloride with those obtained by using granulated calcium chloride.

Results of Various Curing Methods

Figure 1 contains a graphical comparison of the results of the various curing methods as indicated by the moduli of rupture of the specimens in Series 1, the results shown being the average of 11 specimens. As the curing of concrete with 2 inches of dirt wet for 14 days has been considered by this state a satisfactory method of curing, the specimens cured under this method have been regarded as 100 per cent cured and the results obtained by other methods taken as a percentage of this. As shown in the figure, only those specimens which received no treatment showed a strength less than 100 per cent, while the specimens cured with 3 pounds per square yard of calcium chloride indicate the maximum of 116.9 per cent curing. Those slabs cured with 1 pound per square yard of calcium chloride also show a high degree of curing.

Figure 2 contains a graphical comparison of the results of the various curing methods as indicated by the moduli of rupture of the specimens in Series 2. For the purpose of comparing the results at 28 days of one curing method with the results of another at 14 days, the moduli of rupture of the specimens at both ages are contained in this figure. As in Series 1, the specimens cured with 3 pounds per square yard of calcium chloride indicate by far the best results. It should be noted that the strength of these specimens at the end of 14 days is within 20 pounds per square inch of the strength of those specimens cured with wet dirt at the age of 28 days. This early strength obtained with using calcium chloride curing would indicate that a pavement could be opened for traffic at the end of 14 days, whereas under the old method of curing it was felt unsafe to subject a pavement to traffic in any less time than 30 days. The results obtained from the specimens which were treated with calcium chloride that was removed some hours later illustrate that at the end of 28 days proper curing has taken place. In other words, if the calcium chloride remains on the concrete for a period of 24 hours, its removal will not affect the curing of the concrete. Later tests in this regard illustrate that even less time than 24 hours was required for calcium chloride to properly cure concrete.

A brown surface stain developed on the specimens cured with magnesium calcium chloride. This discoloration of the concrete seems to result from the use of magnesium calcium chloride, and for this reason this material as a curing agent is eliminated.

It is evident in the comparison of results on the specimens cured in like manner, but having both a normal and an oiled subgrade, that no benefit is derived from the oiled subgrade. In both the 14- and 28-day tests less strength resulted from the specimens placed on the oiled subgrade than was obtained with the normal condition of subgrade.

Figure 3 contains a graphical comparison of the results obtained in the specimens of Series 3. In the comparison between the results of using the dry calcium chloride and the calcium chloride in solution the dry calcium chloride indicated much the better curing at the end of 28 days. The effectiveness of the calcium chloride appeared to be diminished when in solution.

In the comparisons made between the results obtained with flake calcium chloride and those obtained with the granular form of the material, the indications were that the granular gave slightly better results. However, the difference was slight, and in actual practise the flake or granular forms of calcium chloride are considered equally good.

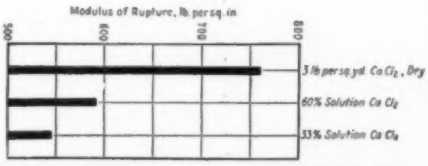


FIG. 3. RESULTS OF 28-DAY SPECIMENS, COMPARING THE USE OF DRY CALCIUM CHLORIDE WITH SOLUTIONS OF CALCIUM CHLORIDE

Each result recorded in this table is the average of three specimens

To gain an insight into the hygroscopic properties of calcium chloride, a test was made which illustrated very conclusively the power of this material to attract moisture from the air. Mortar specimens of exactly the same weight were made up, some being surface-treated with calcium chloride and some receiving no treatment. In order to insure against a base of variable absorbent properties, the specimens were made up on tin, which allowed no loss of water through absorption. At regular hourly intervals these specimens were weighed. The specimens which were untreated lost weight immediately after making. It was noticeable that an increase of weight was secured in the treated specimens up to 45 hours after they were made, after which a gradual loss of weight developed, but to a less extent than in the untreated specimens. The increase in weight secured by the treated specimens in the first 45-hour period would illustrate that the calcium chloride not only prevented the moisture in the concrete from evaporating, but also was responsible for securing additional moisture from the air. A graphical comparison of the results obtained in this test is given in Figure 4.

For the purpose of studying the action of calcium chloride on cement, a number of cement mortar briquettes were made and subjected to various amounts of surface applications. When these briquettes were broken (no consideration

being given to the strength), a depth of penetration of calcium chloride was noticeable.

A study was also made of the effects of concentrated and excessive amounts of calcium chloride on the surface of mortar briquettes The proper distribution of this material is a constant source of trouble with the Highway Department, and it was thought advisable to learn as far as possible in the laboratory the effects of too much calcium chloride on the surface of concrete. Consequently, a number of briquettes were made and were subjected to surface applications of calcium chloride up to what would amount to 10 pounds per square yard of surface. A puffing up of the surface was noticed, with the result that a deadened concrete was developed. The danger of a like condition developing in a pavement surface is seen when, in cases where moisture is present in the calcium chloride drums, the salt has a tendency to lump into pieces of considerable size. When these pieces are larger than the size of an egg their use should not be allowed until they are broken up, since injurious effects of uneven application of the salt will result.

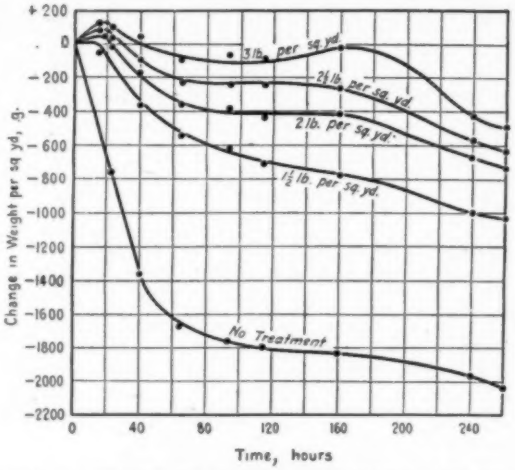


FIG. 4. CHANGE OF WEIGHT OF TREATED AND UNTREATED SPECIMENS OF CONCRETE

Theory of Action of Calcium Chloride on Concrete

Though the exact action which takes place in the concrete when a surface application of calcium chloride is made is not known, a theory has been advanced which appears to be the most logical of any yet presented. The great amount of work done with calcium chloride by the Illinois Highway Department corroborates, so far as is known, the theory, which is as follows:

The hygroscopic properties of calcium chloride are responsible almost entirely for the value of the material as a curing agent. Though the calcium chloride may not obtain sufficient moisture from the air to satisfy this property, its presence on the surface of a concrete specimen which contains more moisture than the air, attracts moisture to aid in the dissolution. This action of the moisture being drawn to the surface of the specimen leaves minute channels, which, after the complete dissolution of the chemical, affords passages for the calcium chloride solution to penetrate the surface, thus giving it access to more cement particles and causing more complete hydration in a shorter time. This quick hydration and decomposition of the lime compounds of the cement particles on the surface causes an impervious layer which prevents the drying out of the concrete. It is also probable that the viscous or oily film of calcium chloride which is formed on the surface offers a protection against the drying effect of the air.

An understanding as to the reason for approximately as great a strength resulting in 14 days from the use of calcium chloride as that resulting in 28 days when curing with wet dirt is apparent when the two methods of curing are considered. In curing with wetted dirt, the increase in strength and hardness of the concrete is due to the ever present moisture, which gradually hydrates and decomposes more of the lime compounds. In curing with calcium chloride, the chemical acts as an accelerator in hastening the hydration and interreaction of the cement particles on and immediately below the surface. This action, due to the nature of calcium chloride, is much more rapid than the same effect produced by the wetted dirt, with the result that the specimens cured with calcium chloride usually show a much higher strength at early ages than do those cured with wetted dirt.

Result of Investigation on Curing Pavements in Illinois

As a direct result of the investigation in curing concrete, the Illinois Highway Department is now permitting the use of calcium chloride in curing state highways. In order to reduce the cost of curing by this method, the amount used has been specified as 2½ pounds per square yard of surface, this amounts being considered as effective as the 3 pounds which were employed in the tests. In order to acquaint the engineers and contractors with the use of this material, a circular has been issued which reads as follows regarding the proper application of calcium chloride for curing:

"Calcium chloride may be used in connection with curing of pavements, taking the place of the usual curing with earth and water, or the curing with water by what is known as the 'ponding method.' Two and one-half pounds of the flaked or granular material (the flaked is preferred as it is more easily distributed and less easily removed by wind or rain) shall be applied to each square yard of pavement and it shall be distributed uniformly over the surface of the finished pavement by means of a mechanical drilling device or by the use of shovels and long-handled brooms. The material shall not be spread upon the pavement until the latter has thoroughly set—ordinarily from six to eight hours after laying the pavement. Care shall be taken that the material is uni-

formly spread and if, in the opinion of the engineer, a uniform distribution is not obtained from the shovels, a thorough brooming shall be required. All lumps shall be broken up and uniformly distributed over the surface.

"Calcium chloride shall not be applied during rains, and experiments have definitely determined that if a rain follows the placing of the calcium chloride after a period of two or three hours there will have been enough absorption of the calcium chloride by the new pavement preceding the rain so that there will not be required additional applications of the material.

"Although the water line for curing of pavements with water may be omitted where central mixing plants are operated and calcium chloride is used in curing, nevertheless the general specifications with regard to wetting of subgrade and the general specifications with regard to placing of burlap on the freshly deposited concrete and the wetting of burlap shall be strictly enforced. The use of calcium chloride for wetting the subgrade will not be permitted. When calcium chloride is used in curing, the sides of the concrete pavement shall be banked with earth as soon as the forms are removed."

ACKNOWLEDGMENT.—From a paper presented before the Twenty-sixth Annual Meeting of the American Society for Testing Materials.

Quick-Setting Lime Blocks Developed

A CAST lime building tile for use in making partitions has been developed at the Bureau of Standards by the Fellow of the National Lime Association. The material of which it is made sets so that it can be removed from the mold at the end of ten minutes. After twenty minutes it can be handled, and after seven days it has a compressive strength of 100 pounds per square inch. It can be sawed, and nails can be driven into it.

The material is composed of five parts by volume of ground quicklime, ten of hydrate or slaked lime, and one of wood fiber. It is found to cure best when outdoors exposed to the weather. The new tile is about 20 per cent heavier than gypsum tile of the same size.

QUARRY LAYOUT OF THE FLORRISANT CONSTRUCTION, REAL ESTATE AND INVESTMENT CO., A SUBSIDIARY OF THE UNITED RAILWAYS OF ST. LOUIS

This quarry is located on the Manchester Road and the Kirkwood-Ferguson car tracks in St. Louis County. A No. 5 Telsmith crusher with hoist, derrick, skips and bin fittings, all furnished by the Geo. F. Smith Co., St. Louis, is used

Clippings for Contractors

Who Restricts Apprentices?

RESTRICTION of apprentices has been a common complaint against labor unions. The condemnation is a general one. We are told that one of the reasons for the shortage of building mechanics is that the unions restrict entrance into the trade. Whatever may be the truth in specific instances and places, the facts at New York at least do not warrant the charge. There it is the contractors and not the unions who restrict apprentices. For example, in the Carpenter Trade Union rules would permit of the employment on New York operations of 2,600 apprentices. As a matter of fact, there are only 800 in the city. The Painters' and Decorators' Union would allow 800, but only 125 apprentices are to be found. In general there are at work only 40 to 50 per cent of the apprentices allowed by union rules. The only exceptions are in the bricklaying and the electrical trades, where the quotas are nearly full. Where the number of apprentices is below quota the reason invariably is that the contractors are unwilling to go to the trouble of training the boys. Of course, union rules do place limitations on apprentices, but until the time comes when the contractors have employed all the apprentices that the unions allow, contractors have no reason to complain against union restrictions, and the public charge against the building industry should lie at the door of the contractor and not at that of the union.

—*Engineering News-Record.*

Winter Construction Necessary

IF contractors prosecute winter construction, it means that a solid organization of men may be preserved. With the present scarcity of workmen worthy of the name, this is a matter of sufficient weight to make its consideration worth while. For, after all, the success during the next few years is going to depend a whole lot on organization. The contractor who has built a Gibraltar group around him is surely the contractor who can face whatever may be coming, be the coming events drops in business, or just plain plugging along in business.

But the contractor, to profit by winter construction, has to brave the winter elements. There is no fairness in boosting winter construction without stating what every one knows to be true, namely, that it offers problems which do not have to be met in construction at other seasons of the year.

And the contractor is not the only one who will be benefited by winter construction. The material manufacturer will be benefited, as will all the intermediate interests handling materials. The railroads will be benefited. Now, the material men, for the most part, can produce for winter construction as cheaply as for construction at other seasons of the year. Therefore, to hasten the general feeling on the part of the public and on the part of contractors that winter construction is worth while, why will it not be a good feature for discounts to be offered on the basic construction materials placed for winter building?

—*The American Contractor.*

A Pyrrhic Victory

PYRRHUS, King of Epirus, won many victories. Each conflict, however, only served to bring ultimate defeat nearer, and to pave the way for his final undoing. The recent defeat in Pennsylvania of legislation designed to permit the use of bankable securities as surety on contract bonds, furnishes a case in point. The efforts made by state officials, constructors and others in behalf of this legislation should furnish food for sober study upon the part of the surety companies. Well-organized lobbies, and legislators interested in the surety business, cannot forever hold up progress in this direction. Each victory will be more dearly bought and will serve to focus attention more strongly upon a matter in which the taxpayers have a paramount interest, and regarding which they will ultimately be heard from in no uncertain terms. The people enjoy competition from the constructors who build their highways; they enjoy competition from the producers of most of the machinery, material and supplies entering into those roads. When a constructor buys machinery, materials and supplies, he trafficks with the producers of these things and secures the best prices afforded by the market. These prices are reflected in his bid. When it comes to the cost of his bond, however, a fixed price only is reflected. The rates charged by the surety companies are the same under all conditions.

The road to reform still lies open before the surety companies. Their old stock arguments as to need for solvency of underwriters, deceptive, financial statements of constructors, acceptance of rebates, etc., will not always be taken as an excuse for failure to do their own "house clearing" and work out a system of sound practice. Closed associations and standard rate cards, assuring a scale of premiums commensurate with reckless underwriting, will not forever be accepted by a long-suffering public.

Belshazzar, sitting at his feast, could not read the handwriting on the wall until it was too late. No one has any complaints against the surety companies so long as their business is conducted in accordance with sound system and with free play allowed to natural economic laws. Will they persist in ignoring these principles until the Persians are at their gates?

—*Highway Builder.*

LEGAL POINTS FOR CONTRACTORS

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

Recital of Full Payment in Receipt or on Check not Conclusive

Where a contract for moving dirt provided for compensation to the contractor on a cubic yard basis, the fact that the contractor received checks in payment for work as it progressed, on which it was recited that they constituted full payment for the work up to the dates specified in the respective checks, did not preclude the contractor from showing that an additional sum was actually due. So holding, the Kentucky Court of Appeals said in the case of Garriott vs. Brandeburg Construction Co., 251 Southwestern Reporter, 935:

"The checks were so indorsed as to be receipts. We have frequently held that a receipt showing that a given sum has been paid, when in fact it has not, or a receipt in full is given, when only a part of the sum due has been paid, while prima facie evidence of the fact, is not conclusive upon the party giving the receipt but he may in avoidance thereof show the truth."

Scope of Michigan Public Contractors' Bonds

A Michigan statute governing contracts for public building and public works construction requires a bond to be given by the contractor "for payment of all labor performed and materials furnished," etc. A bond was given by a state highway contractor under this statute, and question was raised as to whether the bond secured payment for cement bought for but not actually used in the work. Answering this question in the negative, the Michigan Supreme Court lately said:

"It is true the authorities in other jurisdictions are not in harmony upon that subject, and in some states under the wording of their statutes it has been held that the surety is liable for material bought and furnished in good faith for use in the work contracted for, although it was rejected or otherwise disposed of by the contractor and did not become a part of the construction, apparently on the theory that the contractor became an agent of the surety for the purpose of contracting such liability. This court has taken the view that to so extend the statutory protection 'would tend to impair, if not absolutely destroy, the value of the bond to those who, in fact, did perform labor or furnish materials in the erection, repairing, or ornamenting of such buildings, works, or improvements.'" (192 Northwestern Reporter, 787.)

Validity of Promise for Additional Compensation

There is a fundamental legal principle that there can be no enforceable contract obligation unless there is some sort of consideration to support the obligation. And there is a related rule that a promise to do what one is already bound to do ordinarily will not constitute a sufficient consideration for an agreement by the other party.

But a decision of the Minnesota Supreme Court (63 Northwestern Reporter, 482) shows that there is an equitable qualification of this rule. The case before the Court involved the right of a contractor to enforce a promise to pay him extra compensation for performing a contract after discovery of previously unforeseen difficulties affecting the expense of performance. Laying down general rules, the Court said:

"Where the party refusing to complete his contract does so by reason of some unforeseen and substantial difficulties in the performance of the contract, which were not known or anticipated by the parties when the contract was entered into, and which cast upon him an additional burden not contemplated by the parties, and the opposite party promises him extra pay or benefits if he will complete his contract, and he so promises, the promise to pay is supported by a valid consideration. . . . Cases of this character form an exception to the general rule that a promise to do that which a party is already legally bound to do is not a sufficient consideration to support a promise by the other party to the contract to give the former an additional compensation or benefit."

When a Contractor Guarantees That His Work Will Stand

That guaranty clauses sought to be imposed against contractors should be closely considered before the agreements in which they are embodied are signed is an object lesson to be deduced from the decision handed down by the Illinois Supreme Court in the case of Lake View vs. MacRitchie, 25 Northeastern Reporter, 663. It was decided that a contractor was bound by a clause in specifications to the effect that he would guarantee his work for one year, although unsoundness developing was not due to defective material or workmanship. The Court said:

"No reason is perceived why contractors may not guarantee against all defects, whatever their origin—whether they arise from insuffi-

ciency of the materials supplied, from unskilfulness of workmen, or from unfitness of the plan or design—whether devised by the one or the other of the parties, or by some other person. In case of a contract with such warranty, it will be presumed that the consideration for the guaranty was included in the price agreed to be paid for the work to be done. It is not unreasonable to suppose that one desiring a fabric or structure, or an apparatus, or a piece of mechanism to be made, the idea of which is his own, or that of his servant or agent, may wish to take the judgment as to its practicability, usefulness and durability, of some person or persons who have a practical knowledge and experience in the construction of things of that sort, and in such case the requirement of a guaranty would be an effectual way of getting the benefit of such judgment. It is the province of the courts to enforce the contract which the town and these contractors have made—not to make a contract for them. It must be presumed that, had it been their intention to limit the guaranty to the workmanship of the contractors and their servants, and to the materials furnished, such intention would have been expressed in the contract."

Contractor's Right to Compensate as for Extra Work

Determining rights under a sewer construction contract, the Missouri Supreme Court said in the late case of American Contracting Co. vs. Norton, Head & Denneen, 253 Southwestern Reporter, 372:

"As a general rule, labor and materials cannot be classed as extras for which a contractor may recover, where they are incidental and necessary to the execution of the contract. . . . In the Fruin Case the contractor was to make excavations at a certain stipulated price for dirt, and at a certain stipulated price for solid rock. In excavating he struck flint rock and wanted to charge extra for it because of its hardness. Plaintiff was led to believe that the only solid rock he would encounter would be limestone. The Court held that the plaintiff was bound by his contract to excavate the flint as solid rock, although the evidence was that it was worth four or five times as much to excavate flint rock as limestone.

"Here it was an unforeseen difficulty that required the steel sheet piling to be left in the trench for a certain period in order to protect the work, but it was within the terms of the contract that the plaintiff should perform it without extra charge."

Duty Toward Adjacent Property in Excavating

Neither an owner of property being improved nor his contractor is an insurer against subsidence of the soil or buildings on adjacent premises, on account of excavation made in the course of the improvement, holds the Connecticut Supreme Court of Errors in the case of Canfield Rubber Co. vs. Leary & Co., 121 Atlantic Reporter, 283. The extent of liability for injury to the adjacent premises is measured by a duty to use a reasonable degree of care and skill to avoid injury. So it was decided that if a sewer could not be constructed without injury to abutting property the owner of such property was not entitled to the exercise of more than reasonable care to avoid unnecessary damage, after notice of intention to make the improvement.

Obligation to Furnish Lateral Support in Excavating Operations

In the case referred to in the preceding item, the Connecticut Supreme Court of Errors said, in a general discussion of the measure of care to be observed to avoid injury to premises adjacent to excavation sites:

"The duty of furnishing or maintaining lateral support to the adjoining soil in its natural state is an absolute one, and arises out of ownership, or permanent or temporary control of adjoining land, and this duty may introduce a complicating factor into the situation, even though the land is built upon. Laying aside that possibility, the qualified duty of temporarily maintaining or furnishing lateral support to soil burdened with buildings does not impose a servitude on the land or limit the owner's right to improve it at will. It does require him, in carrying out his improvements, to use reasonable care and skill, and to that extent it is a limitation on the manner in which he may perform the work of improving his land. It is, of course, impossible to define in advance what will constitute reasonable care in a given case; but the authorities seem to justify the following general observations: The excavating owner is required in the first place to use reasonable care to find out in advance, or as the work progresses, whether it is liable to cause damage to his neighbor's building; and, if so, to notify the owner in time to give him an opportunity to protect the building against damages which cannot be wholly averted by the exercise of reasonable care in the performance of the work. Reasonable care in the performance of the work will generally require no more than the adoption of commonly used and approved methods of preventing the adjoining soil burdened with buildings from moving into or toward the excavation. After due notice the owner of the building must protect himself against risks caused by its additional weight upon the soil, which cannot be averted by such methods."

Proof of Inferior Workmanship in Cement Construction

Ordinarily, the courts disfavor attempts to prove the condition of a structure, or other work, at a given time by showing its condition at some remotely later time. But, in the recent case of Bond vs. Damon, 97 Southern Reporter, 3, the Mississippi Supreme Court decided that it was proper to show, on a controversy as to whether a foundation had been constructed in a workmanlike manner, the condition of the wall 15 or 18 months after its construction; it appearing that no material change had occurred in the meantime. It was found that the ingredients out of which the foundation was built were not properly mixed.

The History of Cranes

An Outline of the Development of Locomotive Cranes

WE marvel that the pyramids were ever built. They would be a credit to modern construction with all its mechanical aids, and yet were built five thousand years ago—fifty centuries—with nothing but individual man-power. Powerful cranes were unknown, of course, but the huge blocks of stone, weighing from 2 to 60 tons, were handled. Man was forced to develop his own power, without even the assistance of derrick, winch, or block and tackle. Yet these pyramids stand to-day as monuments to the memories of those early men of industry, and they bear tragic testimony of hardships endured.

Although equipment was lacking, men were plentiful, thousands of prisoners of war being enslaved by the victorious Egytians in their various combats. The Egyptian kings were cruel taskmasters, ambitious to build huge tombs as monuments to perpetuate their greatness, and they were totally indifferent to the feelings of their prisoners. Natives were forced into bondage and made beasts of burden in order that the ambitions of these kings might be realized. Placing the huge stone blocks of the pyramids was simply a matter of a sufficient number of men. For what meagre information there is available as to the methods used, we are indebted mainly to Diodorus (40 B. C.).

The roads leading up to the site of the pyramids were made fairly smooth with stone paving blocks. Ropes were then fastened to the stone block which was to be hauled up the incline to its position in the structure. Hundreds and possibly thousands of men were arranged in files, each file with its own rope. In order to ease the task somewhat, water and oil were poured on the wooden runners under the load, while pinch bars were used to get it started and to assist it over the rough places on the inclined roadway.

But this was not all. As the work progressed, the mammoth stones must be placed higher and higher, until finally they had to be raised 200 or more feet above the ground. To do this, huge mounds of earth were built, forming inclined planes reaching to the necessary height, and the blocks of stone were then dragged up these inclined planes. Picture for a moment the thousands of men in long files, straining every sinew in their bodies, perspiration coursing down their faces and backs, muscles bulging as they exert every ounce of energy in them. This, day after day for years, under the lashes and curses of the slave drivers.

It is difficult for the mind to grasp the amount of human labor that is concentrated in even the one pyramid of Cheops in Gizeh, completed 3733 B. C. It is nearly 756 feet square, is 451 feet high, and is composed of 206 courses of limestone that vary irregularly from 4 feet 10 inches, to 2 feet 2 inches in height. The blocks of stone in the mass vary in weight from 2 to 60 tons, and 100,000 men were employed for 20 years in placing them.

Then compare this with the ease with which the task could be accomplished with a modern locomotive crane such as illustrated here. How easily one of these huge stones could have been lifted, placed on a car, hauled to the pyramids and placed in position! The whole process would have required a crew of less than half a dozen men, and would have consumed only a fraction of the time which history shows was actually taken.

If we have interpreted correctly the description given by Herodotus, the ancient Egyptians did use a very crude form of crane for handling some of their stones, for he says a "machine made of short pieces of wood" was used. The most noted authorities believe that this machine was used for placing the casing stone on the pyramids, according to "The Mechanical Triumphs of the Ancient Egyptians," by Commander Barber, U. S. N. This contrivance has been named the "shadoof," and it has been used in Egypt for probably 50 centuries.

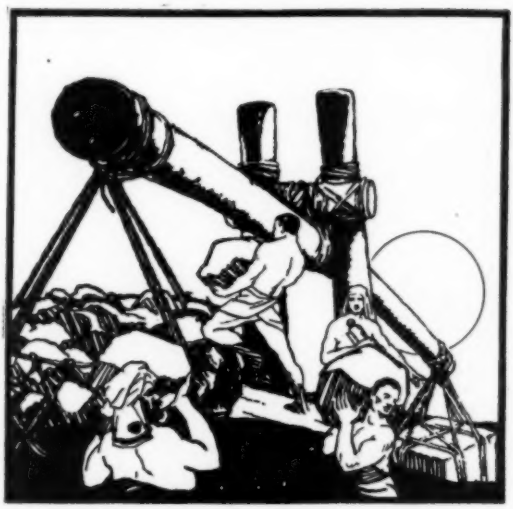
In this machine the load was attached to one end of a beam, and a rope basket was fastened at the other end. Laborers picked up heavy rocks, carried them up the incline and put them in the basket. They continued this until the weight of the rocks overbalanced the load and

MODERN LOCOMOTIVE CRANE HANDLING HUGE STONE

thus forced it upward. After the load was swung around, placed in position and unfastened, the rocks were removed from the basket, so that the beam lowered and the same operation could be repeated. The shadoof was the prehistoric ancestor of the modern locomotive crane, and it was indeed a marvelous machine for its time.

The Hindoo "Picotah," another form of the ancient crane, was used for lighter work, such as lifting water out of wells. This was operated by a man walking back and forth.

Later, prior to 500 B. C., some unknown genius conceived the "parbuckle." This was used by Pæonius, the Greek architect, in building temples. The heavy building stones were padded with pieces of wood so as to make rolling cylinders. Ropes were passed around each of these cylinders, one end fastened to a "dead man," and the other end pulled in by a gang of men. More than twice the load could be handled with the same number of men as by a direct pull. Much the same device is now used to handle loads by hand that are too heavy for direct lift.



THE SHADOOF, A MACHINE MADE OF SHORT PIECES OF WOOD, USED BY THE EGYPTIANS FOR HANDLING LARGE STONES

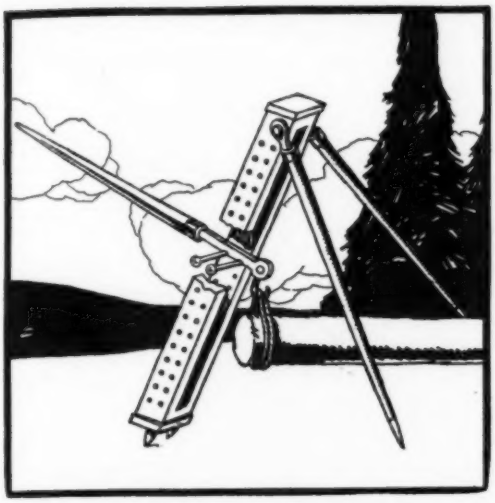
Archytias, a disciple of Pythagoras, is credited with having invented the single pulley about the same time. Previous to this, ropes on sailing ships were run through rings at the top of the mast, and naturally this caused wear and friction. The single pulley was a decided improvement.

Archimedes, who lived about 200 B. C., was also a pioneer in mechanical engineering. It is believed that he developed the single pulley of Archytias into the block and tackle, having a number of pulleys and a number of parts of hoisting rope. This enabled him to lift much heavier loads than was possible with the single pulley. His block and tackle was largely used on ships for handling the sails, and possibly for some of the heavier pieces of cargo.

AN EARLY BLOCK AND TACKLE LARGELY USED FOR HANDLING SAILS ON SHIPS

It was Archimedes who said, "Give me a place to stand and I will move the earth!" This remark is supposed to have caused Hero, king of Syracuse, to request Archimedes to illustrate his contention that a very great weight could be lifted by a very small force. While full details of the demonstration are lacking, it is supposed that a crude form of block and tackle was used by which a large and heavily laden ship was hauled out of the water onto dry land on a "marine railway."

The early Romans were very well acquainted with the block and tackle, using it extensively in their construction work and in their military operations. They even had a crude form of derrick, called the "corvus," on their fighting vessels. It consisted of a ladder hinged on the lower end to the mast so that it could be swung out over an enemy's vessel. At the walls of their military fortifications a similar device was used to place the soldiers outside of the wall when they were



THE LEVER HOIST, AN INGENIOUS DEVICE FOR LIFTING HEAVY LOADS SHORT DISTANCES

ready to make an attack on the enemy.

In Commander Barber's book is shown a reproduction of a sculpture of a Greek or Roman tomb built about 40 B. C., the original of which is now in the Lateran museum in Rome. It may have been on the tomb of an architect or builder, since it portrays an ancient form of derrick used in the construction of temples. The device even had a treadmill for turning the hoisting drum. This sculpture is doubtless the earliest direct evidence of the use of the block and tackle, and it carried the name of "Polyspaston," meaning many pulleys.

Fifteen hundred years after the beginning of the Christian era there lived in Italy a great genius, Leonardo da Vinci. His accomplishments were many, for he was equally eminent as an artist, an architect and an engineer. His sketchbook has been preserved to this day, and it contains his working sketches of lever hoists, blocks and tackle and derricks in a profusion of applications. If he could have taken one more step, three hundred years in advance of his time, and invented the steam engine, this genius might have built the first steam locomotive crane. As it was, he sketched a workable design of an airplane, but without power.

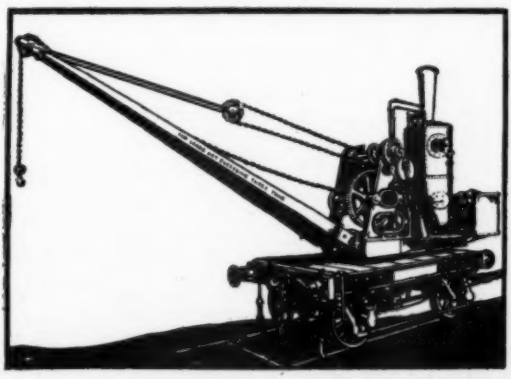
The lever hoist is a very old type of hoisting device. During the Middle Ages in Europe it was quite generally used for lifting heavy loads short distances. One form consisted of a lever with two pins as variable fulcrums, one of which was moved up by hand at each stroke of the lever. In another form, the fulcrum was made of pawls and ratchets which were automatically engaged by a spring. Our modern automobile jacks are much like this form of lever hoist, as are similar modern contrivances.

To overcome the limited lifting range of the lever hoist, the drum and crank was developed. In this evolution the variable fulcrum became a shaft held in rigid bearings, and the short end of the lever became the radius of a drum, so that the load could be lifted continuously and for a much greater distance. The long end of the lever was a crank, rotating continuously in one direction.

The treadmill, another form of drum and crank, has been used in Europe for several centuries. Doubtless there are some still being used, as in the olden days, chiefly in the work of unloading boats and raising coal from mines. Loads were lifted by men walking forward in the treadmill, and lowered by walking backward. This was dangerous practise in cases where the load dropped too fast, and the device would certainly not meet with the modern safety requirements of industries in the United States.

A set of gears was next developed to increase the power of the drum and crank, and following this was the addition of a boom so that a load could be lifted at some distance from the winch. The third improvement was to place the winch, with its boom, on a post so that it could be made to rotate. Thus was born the pillar crane, dating back to some time in the eighteenth century, the exact date being unknown.

The development of the pillar crane did not stop here, however, because the post was soon mounted on wheels to increase the usefulness of the device. This resulted in a crude form of locomotive crane, the direct ancestor of the modern machine. Probably the first locomo-



THE FIRST STEAM CRANE, DEVELOPED BY APPLEBY IN LONDON IN 1861

tive crane operated by hand power was built by Henry Maudsley in England in 1811.

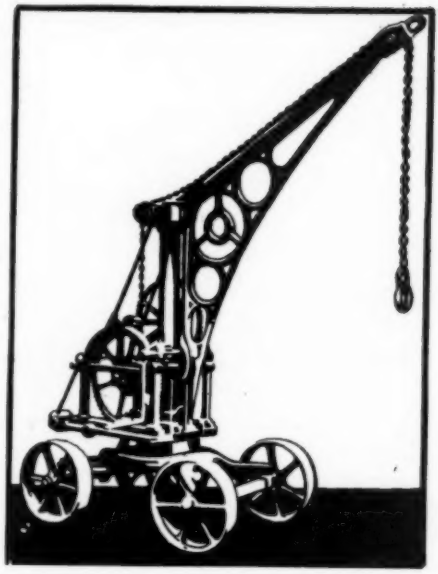
The remarkable development in cranes really began with Watt's invention of the steam engine toward the end of the eighteenth century Following this invention, came Stephenson's locomotive and Fulton's steamboat early in the nineteenth century, coincident with experiments in the application of steam to locomotive cranes.

The first steam locomotive cranes were built in England. It is not clear from available records just who built the first steam locomotive crane or where it was built, but the *Engineer*, of London, for May 28, 1909, shed some light on this question. The first of a number of stationary steam derricks was built by James Taylor, of Birkenhead, in 1839. These had single-cylinder vertical engines with fly-wheels, which Mr. Taylor says he found dangerous. Accordingly, in 1853, he took out a patent for a steam winch, including the application of link reversing motion, with double cylinders and no fly-wheel.

The designing and building of the first steam locomotive crane was carried on between the years of 1852 and 1858. It appears the design was made by W. W. Hulse and the crane built by James Taylor.

There is definite record of a steam locomotive crane built by Taylor in 1859 or 1860 and supplied to W. W. Hulse. The drawing in the *Engineer* shows that it is wonderfully good design for an early crane. It is full revolving with a variable radius boom, vertical engines, a short locomotive-type boiler, and the whole mounted on a neat four-wheel railway car.

Independently, and at about the same time, the Appleby brothers of London built their first steam cranes, but their first one came out a few months later than Taylor's crane. C. J. Appleby felt the need of something of the kind when erecting bridges in Russia in 1851, but it was in 1861 when they brought out the first crane. It was a rather crude machine, as may be seen by the illustration above. They developed and improved this crane, and their product was soon used all over the world. Their hand cranes were exhibited at the International Exposition at London in 1851 and their steam cranes at Paris in 1867, and at Vienna in 1873. They issued a catalog in 1869. It is recognized, therefore, that America is indebted to England for the first locomotive crane. Appleby brothers' cranes were used and exhibited at the Philadelphia Centennial Exposition in 1876, where they gave rise to much favorable comment on account of their excellence and remarkable capacities as labor-savers. In 1882, C. J. Appleby visited this country and addressed a meeting of the American Society of Civil Engineers on "Cranes as Labor-Saving Machines." He brought out points concerning their flexibility of application that are still true to-day of the modern locomotive crane.



A PILLAR CRANE MOUNTED ON WHEELS BY MAUDSLEY IN 1811 PRODUCED THE FIRST CRUDE FORM OF LOCOMOTIVE CRANE

English builders, however, were not to be permitted to enjoy a market in America for long. Yankee engineers entered the field, and to-day the United States leads the world in the crane industry.

ACKNOWLEDGMENT.—Text and illustrations by courtesy of Industrial Works, Bay City, Mich.

Ventilating the New Liberty Tunnel, Pittsburgh, Pa.

THE contract for electrical equipment to be used for ventilating the new Liberty Tunnel under Mt. Washington, Pittsburgh, Pa., has been awarded to the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., by Booth & Flinn Co., Ltd., the contractors who are building the tube. Included in the contract, which totals approximately $90,000, is the electrical equipment for lighting the new tunnel, which will mean so much to traffic in Pittsburgh.

Work on the equipment will be started immediately at the main works of the Westinghouse Company at East Pittsburgh, Pa. The complete equipment contracted for includes two 200-kilowatt synchronous converters, transformers, two 300-kilowatt synchronous converters, eight 40-horse-power direct-current motors to drive fans, eight 85-horse-power direct-current motors to drive fans, one 10-kilowatt motor generator set, the necessary distributing transformers, street-lighting fixtures, and complete separate parts for motors, rotors and switchboard.

Laying Tile Drains

Important Points to Be Considered in Laying Tile Systems for Land Drainage

THE outlet is one of the most important parts of the drainage system. It should be located well above the stream into which it empties, so that water will drain out at all times. A survey is often necessary to determine the best location. To protect the end of the tile, a concrete head-wall is generally used. It is easy to build, economical and permanent. In order to keep rabbits and other animals from crawling into the tile and clogging it, the outlet should be covered with a wire mesh or grating.

Laying Out the Drain

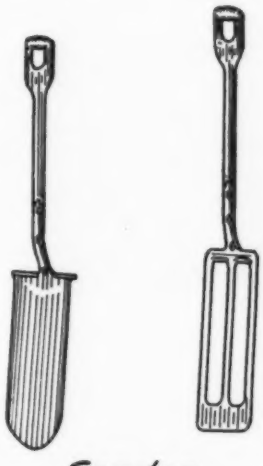
The engineer usually makes a topographic survey of the area requiring drainage. From the data thus secured, a map is drawn which indicates the character of the surface. The entire drainage system is then laid out on this map. When the tile lines are staked out in the field, this map is used. To indicate the location of the tile drain, small square sticks called hubs are driven flush with the ground along the proposed tile line at intervals of 50 to 100 feet. A longer stake is driven about 3 inches in front and a little to one side of each hub. It projects several feet above the ground level and serves as a guide stake for the hub. On it the station number and the exact depth to dig below the hub are recorded.

Digging the Trench

The trench may be dug by hand or by machine. Digging should begin at the outlet and proceed up-grade. A narrow trench is preferable, as it lessens the amount of soil which must be taken out and later filled in. Spades with long, narrow blades have been perfected which make it possible to dig a very narrow trench by hand.

Grading the Bottom of the Trench

Great care should be exercised to excavate to the proper grade so that there will be a uniform slope to the tile drain with no low places. The bottom of the ditch should be dressed with a drain scoop to conform to the curvature of the tile. The tile will then lie uniformly bedded and with close-fitting joints. The exact grade for the ditch bottom is conveniently established by measuring from a line drawn taut over the center or a little to one side of the trench. The accompanying sketch suggests how this may be accomplished. At each hub a pair of stakes are driven opposite each other, one at each side of the ditch and about 4 or 6 feet apart. To support the guide line, a lath or some light piece of lumber is nailed to the stakes at a definite height above the grade established for the bottom of the ditch, usually 6 feet, in which case



TWO TYPES OF TRENCH SPADES

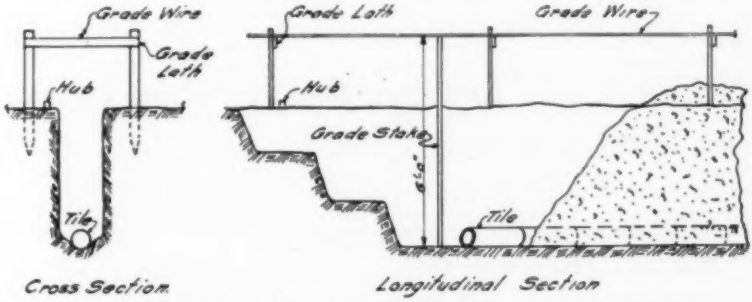


DIAGRAM SHOWING METHOD OF GRADING THE BOTTOM OF THE TRENCH

TRENCH BEING DUG BY MACHINE

a measuring gage 6 feet in length is used to determine the exact depth to the hub. The height to place the cross-bar above the top of the hub may be found by subtracting from 6 the depth of the ditch as indicated on the guide stake.

Laying the Tile

Tile should be laid end to end so that the joints will be nearly closed to prevent the entrance of sand or dirt. It is a mistake to think that tile should be made porous so that water will seep through the tile wall. Even with the closest-fitting joints, enough water will enter the tile line in a comparatively short distance to tax it to its fullest capacity. The tile line should form a smooth, continuous channel having a uniform slope. It will then conduct the greatest volume of water.

As fast as the tile are laid they are covered with about a foot of soil. Sometimes burlap is placed over the tile before the soil is added. Either of these methods will prevent silt from filtering into the tile and filling it up.

Filling the Trench

The trench may be filled by hand, or by team and scraper, or by some appliance designed especially for the purpose. The ditch will usually have to be refilled after several heavy rains, as the loose dirt will settle considerably. Refilling should not be neglected; otherwise water will use the ditch as a channel in times of flood and may wash out the tile.

CONCRETE TILE IN VARIOUS SIZES STOCKED READY FOR USE

Definition of "Lowest Responsible Bidder"

THE term "lowest responsible bidder" does not mean the lowest bidder in dollars, nor does it mean that the board or owner may capriciously select a higher bidder regardless of responsibility or cost. What the law requires is the exercise of a sound discretion by the directors. They should call to their assistance the means of information at hand to form an intelligent judgment. They should investigate the bidders to learn their financial standing, reputation, experience, resources, facilities, judgment and efficiency as builders.

Are You a "responsible bidder?"

Building Conditions in the United States

Prepared by S. W. Straus & Company

General Gain in First Nine Months

GENERAL building activities throughout the country give indication of being fairly well sustained during the fall, according to official reports of September building permits from 251 cities made to S. W. Straus & Company. There was only a slight loss in September as compared with September, 1922, The usual seasonal decline from August was also reflected in an 11 per cent loss, which was in keeping with the usual trend.

For the first three-quarters of the year there was a gain of 25 per cent in the 251 reporting cities as compared with the nine months' period of 1922.

St. Louis, with a gain of 83 per cent, led all other cities in percentage of increase for the nine months' period. Los Angeles gained 63 per cent; Chicago, 60 per cent; Detroit, 38 per cent; Seattle, 35 per cent; New York, 26 per cent; and Philadelphia, 19 per cent.

The Eastern States lost 14.7 per cent in September as compared with September, 1922; the South lost 8 per cent. The Central States gained 24 per cent, and the Far West gained 32 per cent.

Building material prices were all well stabilized during September. Though there were some minor fluctuations, the general level was without significant change; in fact, with the exception of a few grades of brick, building tile and Southern pine lumber, prices of the previous month generally prevailed.

TWENTY-FIVE CITIES
SHOWING LARGEST VOLUME OF PERMITS FOR NINE MONTH PERIOD

Cities	Sept., 1923	Sept., 1922	Aug., 1923	¾ 1923	¾ 1922	Gain Sept.-Sept.	Gain Sept.-Aug.	Gain ¾ '23–¾ '22
New York	$42,353,954	$49,628,756	$51,715,780	$373,265,364	$456,413,529			$117,037,480
Chicago	27,874,705	12,263,100	20,134,150	252,895,967	157,899,660	$15,611,605	$7,740,555	94,996,307
Los Angeles	14,099,353	10,267,894	22,249,262	145,321,073	88,951,053	3,831,459		56,370,020
Philadelphia	7,086,060	11,714,140	8,246,280	101,857,590	85,620,925			16,236,665
Detroit	9,708,727	10,014,311	15,530,072	98,345,411	71,158,554			27,186,072
Cleveland	3,857,650	6,837,905	4,746,725	45,733,065	44,195,390			1,537,675
Washington, D. C.	2,492,668	4,808,942	4,286,358	39,664,568	36,714,154			2,950,414
San Francisco	2,907,389	2,951,858	3,915,300	36,997,385	35,546,683			1,450,702
Baltimore	2,689,800	3,648,540	4,945,320	36,074,314	33,080,780			2,993,534
St. Louis	5,592,630	1,715,117	2,371,005	31,295,965	17,060,560	3,877,513	3,221,625	14,235,405
Boston	2,701,512	2,289,549	1,989,607	30,795,809	30,905,253	411,963	711,905	
Milwaukee	3,216,501	2,058,294	3,009,975	27,512,980	19,232,385	1,158,207	206,526	8,280,595
Pittsburgh	1,814,383	5,609,762	2,872,640	25,619,958	27,932,029			
Minneapolis	2,858,765	2,271,280	2,231,538	25,038,675	23,391,795	587,485	627,230	1,646,880
St. Paul	1,250,212	1,352,121	7,669,049	24,684,521	18,889,608			5,794,913
Newark	2,528,632	2,124,943	3,686,900	22,715,827	19,745,463	403,689		2,970,364
Atlanta	1,131,792	2,319,576	1,363,460	21,731,255	14,051,674			7,679,581
Indianapolis	1,650,949	1,928,956	2,552,795	20,856,990	19,446,577			1,410,413
Cincinnati	1,637,435	2,629,000	1,468,795	20,264,235	20,317,140		168,640	
Portland, Oregon	2,378,060	1,534,005	2,818,355	19,985,770	18,548,140	844,055		1,437,630
Oakland, Calif.	2,147,296	1,789,439	2,118,416	19,949,905	17,496,056	357,857	28,880	2,453,849
Kansas City, Mo.	2,321,750	2,080,800	1,137,750	19,716,756	18,041,390	240,950	1,184,000	1,676,216
Seattle	1,403,825	1,345,820	1,281,130	19,546,713	14,482,505	58,005	122,695	5,064,208
Columbus	2,012,900	1,705,200	2,304,300	19,201,300	13,816,200	307,700		5,385,100
Long Beach	1,405,462	1,317,438	1,566,817	18,175,953	10,894,902	88,024		7,281,051
	$149,122,410	$146,206,746	$176,211,779	$1,697,247,349	$1,333,832,405	$27,778,512	$14,012,056	$386,075,074

SUMMARY OF BUILDING PERMITS BY REGIONS

Region and Number of Cities Reporting	September Reports 1923	1922	August 1923	First 9 Months 1923	1922	Gain or Loss Over Sept. 1922	Over First 9 Months 1922
East 90	96,533,968	113,212,472	112,563,190	1,146,084,699	975,653,892	16,678,504 14.7% Loss	170,430,807 17.4% Gain
Central 84	82,683,046	66,583,680	83,778,190	805,387,836	601,432,342	16,099,366 24% Gain	203,955,494 34% Gain
South 41	17,637,793	19,153,656	19,282,434	192,467,585	158,434,224	1,515,863 8% Loss	34,033,361 21.4% Gain
West 36	32,117,677	24,414,709	42,034,069	330,623,078	243,996,275	7,702,968 32% Gain	86,626,802 35.5% Gain
Total 251	228,992,484	233,364,517	257,657,883	2,474,563,198	1,979,516,733	4,372,033 2% Loss	495,046,465 25% Gain

The Story of One of the Largest Contracting Organizations in America

"No Job Too Large, No Job Too Small, No Job Too Difficult" Has Been the Business Creed of the Ley Brothers, Famous Builders

By Merle Crowell

BOTH the place Fred T. Ley and Company hold to-day and the methods by which they have won it are illustrated by a sequence of events that followed the entrance of the United States into the World War.

Facing the necessity of providing cantonments—each one a city in itself—for the great army of the drafted, the War Department asked the important building contractors of the country to submit statements covering organizations, financial facilities, and also diversity of operations, as well as a reference record of their previous big-scale jobs. These were analyzed and the builders rated. When the ratings were completed, Fred T. Ley and Company headed the list. So to this firm was given the first mammoth contract—for the erection of Camp Devens, at Ayer, Mass.

On June 19, 1917, the award was made. On June 20 the Ley vanguard stood in the middle of a spreading stretch of land covered with scrub pine and oak and without a single highway, which must be transformed at top speed into a city of 60,000 inhabitants, with roads, water and sewer systems, electric lighting plants, and all the other acessories of civilization.

Ten weeks later, on September 1, a city of barracks and offices and mess-halls and assembly-rooms and freight sheds was turned over to the Government. Seven hundred and twenty-eight buildings of varying types and sizes had been erected on the smooth site of the scrub forest.

Besides the soldiers' barracks there were 45 regimental storehouses, 20 administration buildings, a remount depot of 62 buildings with provisions for 6,000 horses, 331 stables, a bakery turning out 40,000 loaves daily, a refrigerating plant producing 20 tons of ice daily, 13 Y. M. C. A. buildings, one with a seating capacity of 3,000, 3 Knights of Columbus halls, a library, and 2 theaters. The base hospital unit, consisting of 60 buildings, connected by glazed corridors, 1¼ miles in length, had a floor area of 250,000 square feet and accommodated 1,000 patients.

There were many other temporary structures, including 30 buildings in which 17,000 meals were served daily. The total floor area of all the buildings of permanent construction was 110 acres.

The Ley Organization on the Job

They started the job on the jump. The ink on the contract had hardly dried when three men from their organization were headed for Ayer. One was a construction superintendent, one a purchasing agent, and one an employment manager. On the train the employment manager wrote "Help Wanted" display advertisements and mailed them to the newspapers. Once on the spot, the pioneer coterie rapidly sketched its plans.

"Well, I suppose that men will start coming to-morrow in answer to our ads," remarked the employment manager as the strenuous afternoon was wearing to a close.

"That's fine—but we must have some tools for them!" broke in the construction manager. 'If the first arrivals start out loafing as soon as they're hired, they'll set the style. We must shoot 'em onto the job double-time!"

Thereupon he climbed into a motor car, drove 40 miles to Boston, and managed miraculously, despite the fact that it was Sunday night, to collect a cargo of shovels. With these he motored back to Ayer, and they were distributed to the first arrivals in the morning. Within a few days 9,000 men were threshing away at the job—with Fred Ley acting as consulting general.

Every movement was coordinated, every activity organized. In the lapel of each man's coat was a numbered button. Men with yellow buttons, from 100 to 300, cut down trees and cleared away the underbrush. The next higher numbered groups, with pink and white buttons, drove posts to serve as foundations for joists laid by the men with a still higher series of numbers. Another group built the frames; above them another aggregation nailed on the roofs. The incredible speed of the job was fairly matched by its smoothness of operation.

One of the early arrivals declared that he was a foreman. "If you're a real foreman, I want you," said the superintendent. "But you've got to *show* me! See that little hill over there? Well, I want an office building 200 feet long and 25 feet wide, with an aisle down the middle and offices every 15 feet on both sides, to be erected there inside the next 24 hours. Snap into it!"

Twenty-four hours later the building was completed. Thereupon the man was made an assistant superintendent—to show other foremen how to get up speed.

But speed is not the outstanding feature of the organization that these Bay State boys have built up. A far more important factor, indeed the keynote of all factors, sprang from a bitter lesson that Fred Ley learned while he was still in short trousers.

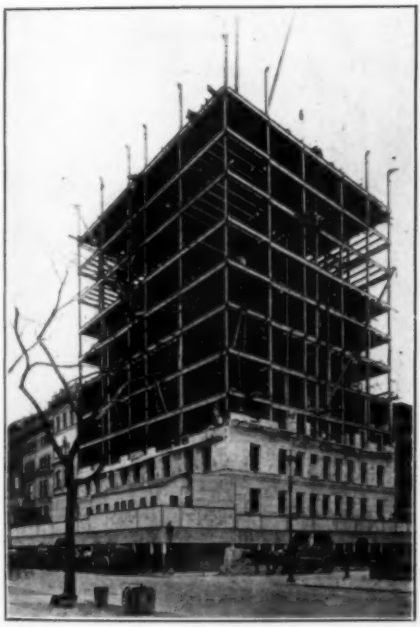
A TYPICAL LEY JOB IN NEW YORK CITY
Building a new apartment house at 820 Fifth Avenue

FEBRUARY 20, 1916

Old building at 820 Fifth Avenue which had to be demolished to make room for the new apartment house

MARCH 20, 1916

Foundations complete and several stories of steel started. Note particularly the sidewalk bridge design and construction



APRIL 24, 1916

Stonework well under way and steel almost topped out

MAY 29, 1916

Building ready for interior trim

Early Life of the Ley Brothers

From the time they were able to trot around the streets of Springfield, both brothers earned money enough to pay for their own clothing. They sold newspapers, picked berries, mowed lawns, and did a thousand and one odd jobs; for the family purse was never over weight. Harold earned 50 cents a week by singing in the Episcopal Church choir, and Fred, while the family was living for a brief period in Worcester, made a dollar a week lighting the gas lamps in his section of the city. It was on this job that he had the significant experience to which I have just referred.

One cold January night, when his rounds were all but completed, the shivering boy halted at an unimportant street, in the middle of which, half a mile away, was a solitary gas lamp. For two minutes a struggle went on inside him. "Guess I'll forget to light it tonight," he mumbled to himself, and started for home on the run. The omission was reported, and he received a warning from the Superintendent of Streets.

A fortnight later, when a nasty blizzard was following a day of intense cold, the youngster decided to "forget" the light again—telling himself that no one would be afoot on such a night. The following day the Superintendent sent for him, gave him a severe lecture, and discharged him.

"It is hard to imagine the impression that this incident made on me," Ley said, years afterward. "I was more than 'fired'—I was disgraced. I brooded over it for days, until finally I came to see very clearly that *thoroughness* was among the greatest of all virtues, that nothing is ever really done until it is done *right*. Then and there I resolved that I would never forget that lesson when I grew up and went into business for myself."

A few days after their father's illness had developed into the dread locomotor ataxia, thirteen-year-old Harold Ley found a job as errand boy with a wholesale shoe firm at $5 a week, while Fred landed a berth as rodman in the City Engineer's office at $1.50 a day. This was pretty responsible work for a boy hardly out of the marble-shooting age; but Fred had a head for mathematics and a passion for engineering—two facts to which the City Engineer gave due credit. Except for $2 a month that Harold had already started to pay toward savings shares in a cooperative bank, both youngsters turned their wages over to the mother.

Climbing Upward

After a few months with the shoe wholesaler, Harold shifted to a job as office boy in the actuary department of a prominent life insurance company. The pay was the same, but the chances of promotion more promising. He was destined to remain here for several years and to absorb information and practises that were to be a shaping factor in his real business future.

Meanwhile Fred was making rapid progress in the City Engineer's office. With the enthusiasm of youth, he soon learned not only his own duties, but those of his boss, the surveyor. Within a year he was earning $3 a day. On the promotion of the surveyor to the office of Assistant City Engineer, the sixteen-year-old boy made local history by stepping into his shoes.

At about this time the City Council passed a ruling that neither the City Engineer nor his assistant could take private jobs. The former surveyor had been doing considerable work for the Springfield street railways company, which was changing from horse cars to trolleys. To this work, as a result of the ruling, the hustling youth now fell heir. He handled the work so effectively that more and more of it was given to him. At eighteen, his earnings exceeded the City Engineer's salary of $1,800 a year. Harold also was receiving promotions and a fattened pay envelope.

"Those were strenuous days for both of us," Fred Ley told me with a smile, as we chatted in his office, high up in a beautiful New York skyscraper which he had built. "In watching the wheels go around, however, I soon saw that in the game I was playing a man could never get very far on a salary. A couple of masons who had saved a little money would bid in a city contract and clean up $5,000 in a few months—which was twice as much as I could make in a year. Although I was only nineteen years old, and had very little capital, I decided to take a chance on bidding for the next likely-looking job.

The First Bid

"A few weeks later the city decided to extend its sewer lines. I went to the Superintendent of Sewers and asked him if I could bid on the job, even though I was on the city pay-roll. He patted me on the back and told me to go ahead.

"For the next few days I turned myself into a computing machine. I studied the proposed job from every angle. I questioned friends who were familiar with this kind of work, and I spent my nights figuring. Finally, I posted my savings of $500 as a guarantee of good faith and put in a bid for $28,000.

"Two days later the City Council held its meeting. I waited in fluttering suspense for the announcement of the award. When the meeting was over the Superintendent of Sewers came to me.

"'Your bid was far and away the lowest, Fred,' he said; 'but the Council, on my recommendation, awarded the contract to the next highest bidder. I think I've done you a favor, my boy. Your bid was too low.'

"I appreciated the Superintendent's interest, but I regretted his action, for I was sure that my offer would have allowed me a profit. And when the bidder to whom the contract was awarded had finished the job it turned out that I was right, after all. The actual cost of the work, I learned, was several thousand dollars under my bid.

For the next two years I divided my time between the City Engineer's office and the street railway company—dabbling a bit in real estate on the side. Harold pooled his savings with

me on one of these realty ventures, and it turned out quite profitably.

"In 1893 I decided to visit the World's Fair at Chicago. In addition to the money tied up in my small real estate holdings I had $500 in clear capital. This would finance the trip. But, just as I was ready to start, I heard that a sewer contract was to be let over in Plymouth, so I decided to take a look at it.

"After studying the situation and doing a lot of figuring, I made a bid of $12,000, leaving my $500 World's Fair stake as a deposit and giving the Springfield City Engineer as a business reference. My $12,000 bid turned out to be $4,000 less than that of the next lowest bidder, an experienced contractor. Yet my exultation at the prospect of getting the contract was tempered by a wave of terror. Had I made too low a bid?

"'I've got a letter from those Plymouth people,' the City Engineer said to me a day or two later. 'They seem to be reluctant to give the contract to anyone so young, and they've asked me about your capacity for handling the job. Now I can write 'em something that will either bring you the contract or else make them turn you down. Your bid seems mighty low. Think it over and decide if you want to crawl out from under!"

"I sat up all night going over my figures. In the morning I told the Engineer that I wanted to go ahead; and a few days later I had started on the job.

The First Contract

All my material had to be bought on credit, and I had to depend on advances from the town to pay my fifty employees.

"Plymouth Harbor at low tide was a spreading stretch of mud-flats, but about a quarter of a mile from the high-water mark was a channel in which several feet of water stood at low tide. The outlet pipe from the system was to run into this channel—a seemingly simple arrangement, but one that nearly plunged me into disaster.

"After puzzling for a long time over the easiest and cheapest method of laying the outlet pipe, I hit on an idea that I felt sure was nothing short of an inspiration: I would have the pipe fitted together on shore, then plug up the two ends and, when the tide was high, float it out to its proper position. After pulling the plugs and letting it sink, we could dig a trench and cover it over with mud at low tide.

"One night when the moon was full and the tide running high, I prepared to stage my idea. The whole town turned out to watch it. A friend lent me his sailboat to tow the plugged pipe line to its proper position. Before we got very far, however, I found out that a sailboat was a mighty poor substitute for a tugboat and that a long line of pipe was about the most unmanageable float that human ingenuity could devise. To make things worse, a brisk breeze began to blow shoreward.

"After a nightmare of a struggle we got the pipe to a position that I felt was approximately correct. So I pulled the plugs and let it sink. At sunrise I saw that one end of the line was 100 feet off-shore and the other end 100 feet beyond the channel!

"I shall never forget the next month. Even after we got the pipe in place, the job of sinking it in the mud was infinitely more difficult than I had imagined. Presently I found that I had spent $1,500 more on this outlet pipe than my schedule had called for—and it was still far from being in place, with winter rapidly coming on. Finally a contractor from Providence agreed to take this section of the job off my hands for the payment of another $1,500. In desperation I accepted his offer, and threw myself into the street work with a resolve that we must make up there the losses I had sustained in the harbor work. Probably I shall never again know a feeling of relief such as that which came to me when I finally wound up the job and found that I was more than $1,000 ahead."

After the mental wear and tear of the Plymouth contract, Fred Ley was content for the next few months to stick to his snug berth in the City Engineer's office and continue to survey for the Springfield trolley system. Although still convinced that the real money of his profession lay in contract jobs, he determined to select the street railway field for his next essay—a field with which he was now thoroughly familiar.

Enlarging Field of Activity

Interurban electric lines were just then coming into the boom period of the middle nineties. After making a close study of the contract system and developing his own lines of procedure, young Ley made a bid for the construction of a trolley line between Hartford and Manchester, Conn. Landing the contract, he handled it in so able a fashion that he not only won the unstinted commendation of the company, but cleared for himself a profit of $12,000. This was followed by similar contracts at Bristol, Manchester, and other New England cities and villages.

By this time his business had grown beyond the limits of one-man direction. A record of thoroughness in accomplishment—based on the philosophy that Ley adopted at the time of the street-lamp episode—was spreading throughout New England.

"The thing that made Ley," a man in the construction business told me, "was the early reputation he gained for doing things right. He would stand losses—and he did stand losses—rather than turn out a job that was short of his absolute best. If the breaks went against him he was a bear for punishment."

ACKNOWLEDGMENT.—Reprinted by courtesy of *The American Magazine*. Copyrighted 1923, The Crowell Publishing Company. Illustrations by courtesy of Fred T. Ley and Company.

An Efficient 300-Ton Crushed-Stone Plant

Dunham Stone Company's Plant Constructed to Work Materials Down-Hill

THE stone-crushing plant of the Dunham Stone Company, located about one mile south of Syracuse, N. Y., on the D. L. & W. Railroad, is built with the primary crusher at the quarrying level and the bin for the finished product on the road level, so that trucks and wagons can load easily. At the present time there is no railroad switch at the plant, so that all material is trucked or teamed into or around Syracuse, where it is all used. The output of the plant is about 300 tons per day, and 12 men and the superintendent can run the plant to capacity, including the quarrying of the rock. The material is a blue limestone and is sold for road building and construction work, and the screenings are sold for the manufacture of cement block. The investment in the plant and machinery is about $40,000.

An 18 x 26-inch Acme jaw crusher is the primary crusher in the plant. They are using a No. 2½ Climax crusher as a tailings crusher and have a 100-foot Climax conveyor which carries the crushed material from the crusher to the bin. A 40-foot Climax elevator takes the material from the tailings crusher back to the scalping screen, so that nothing goes to the bin except the finished product. The scalping screen is 10 feet long by 42 inches in diameter, and the material from the primary crusher drops directly into this screen. The product that is screened out goes onto the conveyor to the sorting screen, which is on top of the bin.

C. H. Rohr is General Manager for the company.

GENERAL VIEW OF THE DUNHAM STONE COMPANY'S STONE-CRUSHING PLANT, LOCATED ABOUT ONE MILE SOUTH OF SYRACUSE, N. Y.

ACKNOWLEDGMENT.—Photograph by courtesy of Goods Roads Machinery Company, Kennett Square, Pa.

America's Road System a Coming World Wonder

Every cent spent for good roads is money well invested. Commercial intercourse is stimulated, cities are brought closer to one another and new arteries of traffic are opened which, half a century back, were filled by the railroad alone. It seems only a question of time before America's highway system will be one of the wonders of the world.

—Crookston, Minn., Times.

Manufacturers ---- Distributors ---- Consumers

Published under the auspices of the Associated Equipment Distributors, Sixteenth Street Viaduct, Milwaukee, Wisconsin

Keeping the Wheels Turning

By C. H. Clark

Business Manager, The K. B. Noble Company, Hartford, Conn.

NO one likes to have his faults glaringly brought out to public view, and yet it is only by airing these subjects that betterments can be effected. "Keeping the Wheels Turning" means—fundamentally—system, order, judgment and initiative in stopping the breaks before they happen.

The elimination by the Contractor of the many small and incidental delays and breakages will have a very direct bearing on the smooth-running operations of his organization, the ultimate profits from the work involved, and the saving of tremendous depreciation bills.

The Contractor is naturally directly responsible for placing men of the proper knowledge and experience in charge of plant equipment and being absolutely certain that the machinery and equipment used shall receive the same care and attention as should other vital elements of the construction work itself, because upon the uninterrupted service of his plant equipment depend the continuity and proper completion of his contract.

Many large and well-organized Contractors maintain efficient service departments in which they dutifully and regularly overhaul, test and care for equipment, placing it after each job in position to go on the next with assurance of its being mechanically sound. Such concerns, however, are in the minority, while, on the other hand, the smaller Contractor is faced with an individual problem of personally supervising, inspecting and choosing his men with more care, as has to be done in any small organization. The small Contractor's problem, as a consequence, is one that he should study with a realization that he has a difficult question to solve and must devise ways nd means of meeting it accordingly. One of these means and the most obvious is—learn to rely on the Distributor's organization for equipment, service and help. Neither the large nor the small Contractor who persists in the practise of engaging incompetent mechanics, attempting to operate a high-grade piece of machinery with a $4 a day laborer taken off a sand dump, can expect anything but grief from the results. You cannot expect from such a type of intelligence the proper interest, nor the possibility of any such man's mastering the intricate details of operating efficiently a fine piece of machinery and keeping it in perfect running order. The daily disastrous results of such practises are an open book to the Distributor and contribute more toward dissatisfaction, trouble and ill feeling toward the Distributor than any other single cause. As a direct result of this and other practises, the Contractor is, without the slighest provocation or justice, led to condemn the plant, to condemn the Manufacturer, and to condemn the Distributor who sold it. We urge every Contractor to search for and engage intelligent men with proper mechanical knowledge, as this will go a long way toward preventing annoying and expensive breakdowns.

Losses from Cheap Labor

Many Contractors claim they cannot hire such men. Admitting that it is difficult, I will quote from a recent experience in which we sold a plant costing $11,000 and urged the Contractor at the time of purchase to look for a competent operator. He asked us also to keep our "eyes open." We found one (an expert) who demanded $1 an hour. We placed this man in contact with the purchaser of the equipment. The purchaser stated that the price was too high. He would not engage him. Result: He took a $5 a day laborer that he thought intelligent enough and broke him in. Two weeks later one of the most important main bearings on the machine burned out. The boom was dropped and badly distorted. Three other important breakdowns resulted, all directly traceable to this cause. The Contractor is now searching for a competent man, realizing that the advice first given him was sound and sincere. This Contractor spent ten times more money on repairs than he would have spent in maintaining a good operator. Stop the leaks —this is one of them.

It calls to mind the old story of Peter, the little Dutch boy hero who, rambling along the dikes of Holland one day, discovered a small leak through which water was trickling. Realizing the vital importance of not having this leak develop into a larger one, he thrust his arm into the hole, stopping it, and remained there for two days without food until the leak was finally repaired. This little boy was heralded as the hero of Holland.

Every big accident has a small beginning. It is the slipping clutch; the loose bolt; the broken pin; the slapping bearing; the piston knock; the loose chain; the wearing gears, and hundreds of other causes that are not corrected in time.

A Striking Illustration

The writer was going over a large road job a few weeks ago and stopped to inspect a paving mixer. The mixer was working smoothly, but on stepping upon the operator's platform I noticed that one of the main counter-shaft bearing bolts had dropped out. I asked the operator why he did not replace it. He claimed that he could not stop and had no one to send down for a machine bolt. He had a piece of bale wire through the bolt hole, twisted taut. I told him the first thing he knew his whole plant would be broken down. He laughed at me and said he guessed not—that it had been running that way for two weeks. I finally left the mixer and continued my inspection trip. Fifteen minutes later when repassing the mixer I found that it was shut down. Coincident with this, the bale wire giving way, the bearing cap went too, allowing the entire main shaft to become distorted and twisted out of shape. The stoppage paralyzed about nine trucks with compartment bodies, the entire loading and unloading gang, the entire mixer gang and the entire pumping plant for nearly an hour and a half, resulting in the loss of at least $600, but, fortunately for the Contractor, the Distributor had parts in stock, otherwise the loss would have been greater. It would have cost in the beginning but $1 to send a truck or light car for a bolt.

The importance of lubrication cannot be underestimated. When the machine is new, the Contractor usually takes considerable care of it. As soon as it becomes a month or so old, it is the old story of letting it run until it stops. Proper methods of lubrication are as vital as the lubricant used itself. Smearing grease all over a chain on a concrete mixer or any traction drive of a unit is destructively wrong. It collects dirt, cement and sand, making a cutting compound which soon ruins the sprockets and chain. Learn the right kind of lubricant which you should use on chains, and at frequent intervals wash the chain with kerosene and relubricate it with fresh oil.

Take off the stub of the grease cups occasionally throughout your machine and see that the oil passage is not blocked. If you lose an oil or grease cup top get a new one. Do not allow it to go neglected for weeks and weeks, because when one bearing goes its companion bearing also goes.

Use the Distributor's Service Department

Time and again when the service organization maintained by the reliable Distributor is in the field or on the job checking over or repairing some piece of equipment, it is traceable and found beyond doubt that had the original instructions, given to the operator when the machine was started, been followed there would have been no cause for the breakdowns or delays. When the Distributor is maintaining an **expert and well-organized service department** exclusively for the Contraetor, to willingly and gladly give him mechanical advice or assistance when needed, it seems poor economy on the part of the Contractor not to take advantage of it.

A good suggestion that a Contractor could well follow is to detail some bright, ambitious young man in his organization and send him around through the plants of two or three Manufacturers for instruction, so that when he returns he will have increased his mechanical knowledge of equipment. Every factory is glad to cooperate, and the Distributor will do likewise. Another point often overlooked is that relatively it does not cost much to properly house machinery when idle and thus prevent rust, damage and theft and afford the opportunity of overhauling, greasing and repainting. This all means lessened depreciation.

In our personal effort to alleviate some of this trouble we interested the largest Contractors in our territory and called a special evening meeting of their foremen, superintendents and executives and gave a little lecture with charts. You would be surprised to know that from no one of these organizations did we have a call for a mechanic for over six months.

If in any way you feel that your Distributor can help you in these problems, call on him and tell him what you want—make use of him. He is like a bank. If you do not borrow from it, it won't make any money. That is what a bank is for, and a Distributor is for the same thing. Borrow from him, and you will find that—unlike the bank—you will not have to pay him back. His experience is free—his nominal service charge you should be glad to pay. Occasionally the factory will play an important part in service work, but as a rule it is far from the job and out of touch with the field end. A manufacturer has his own problems of production and he properly relies on the Distributor to represent him intelligently in the field, and it will always be so. For this reason the Distributor will always bear the brunt of the trouble and must have the courage and ambition to overcome it and meet the obligation, and the Contractor must support him loyally.

In closing, bear in mind that machinery will not take care of or renew itself. The human body will build up lost, wasted and worn tissues but no machine can recover or build up lost bearings, broken nuts and worn gears. They must be replaced by the aid of human hands, and these hands should be trained to do this work intelligently and painstakingly. If this is done, right down the line, it will not be difficult to "Keep the Wheels Turning."

In the November article in this Department the "Winter Care of Equipment" will be discussed by George F. Smith, President of the George F. Smith Company, St. Louis, Mo.

Helpful Catalogs

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

MOTOR AND STEAM ROAD ROLLERS

The Galion Iron Works & Mfg. Co., Galion, Ohio, invites contractors to write or wire at the company's expense for detailed information and prices on Galion motor or steam road rollers, furnished with or without pneumatic scarifier attachments.

HEAVY TRUCKING EQUIPMENT

The Engineering Dept. of the International Motor Co., 25 Broadway, New York City, will be pleased to send literature regarding Mack heavy-duty trucks in capacities from 1½ to 7½ tons, or tractors to 15 tons, to any contractor interested in improving his hauling equipment.

STURDY AND RELIABLE MEASURING TAPES

The catalog of the Lufkin Rule Co., Saginaw, Mich., describes many types of sturdy and reliable tapes suitable for highway and general contracting work.

WATER-METERS

Those interested in a well-built water-meter for domestic or commercial service should secure the literature of the Badger Meter Mfg. Co., 841-847 30th St., Milwaukee, Wis.

MAKE BETTER ASPHALT STREET REPAIRS

The improved Equitable asphalt surface heater, which softens 1,500 square yards of asphalt paving a day, furnishing the proper bond for old and new asphalt, is described in the new price list and specifications of the Equitable Asphalt Maintenance Co., 1901 Campbell St., Kansas City, Mo.

INDOOR AND OUTDOOR METER SETTINGS

The new catalogs of the Ford Meter Box Co., Wabash, Ind., contain interesting and useful data on Ford outdoor and indoor meter settings and accessories, including meter boxes, yokes, stop cocks and meter yoke test valves.

ROAD PLANERS, GRADERS AND DRAGS

If you are in the market for high-grade road planers, graders and drags, be sure to secure the complete descriptive catalog of N. S. Monroe & Sons, Manufacturers, Arthur, Ill.

A CENTRIFUGAL PUMP FOR CONTRACTORS

Bulletin No. 169 issued by the American Well Works, Aurora, Ill., describes the new American EEFD contractors' pump which is direct connected to an air-cooled New-Way gas engine.

POWER DRAG SCRAPERS FOR CONTRACTORS

Sauerman Bros., 464 S. Clinton St., Chicago, Ill., in pamphlet No. 20, just issued, describe the many uses and applications of Sauerman power drag scrapers of all types and sizes in stripping operations, loading cars and trucks, handling gravel and sand-pit operations, making cuts and fills and grading, and storing and reclaiming loose materials.

PORTABLE ELECTRIC TOOLS

A 32-page miniature catalog No. 3027 issued by the Hisey-Wolf Machine Co., Cincinnati, Ohio, describes the 112 different sizes and types of electric portable hand drills, reamers, grinders and buffers.

CAST IRON PIPE IN 6-FOOT LENGTHS

Universal cast iron pipe, which makes its own joints and is manufactured in 6-foot lengths, convenient to handle and easy to lay, and requires no lead, no calking and no bell-holes, is described in detail in the interesting illustrated literature of the Central Foundry Co., 41 E. 42nd St., New York City.

SPECIAL TRUCK EQUIPMENT FOR CONTRACTORS

Complete information regarding the many advantageous points of Garford trucks for general contractors and road builders may be secured from the Garford Motor Truck Co., Lima, Ohio.

TRACTORS MADE FOR ROAD WORK

Holt Caterpillar tractors, which have a long record for building and maintaining roads and streets at the lowest possible cost and the greatest practicable speed for counties, cities and contractors, are described, with their performance records, in two booklets, "Caterpillar Performance" and "The Nation's Road Maker," which may be secured from the Holt Mfg. Co., Inc., Peoria, Ill.

A HEAVY-DUTY CORD TIRE

Something new in a commercial car pneumatic tire, the Goodrich heavy-duty cord, which is provided with a newly developed sidewall construction reinforced with sturdy ribs of rubber, is described in the literature of the B. F. Goodrich Rubber Co., Akron, Ohio.

CONCRETE SURFACING TOOLS

The Abrams double-acting trowel, which makes a perfect surface on concrete pavements or walks with inexperienced help, is described in the literature of the Abrams Cement Tool Co., 3818 Grand River Ave., Detroit, Mich.

STREET-SWEEPING PROBLEMS SOLVED

Special motor sweeper catalog G, issued by the Austin-Western Road Machinery Co., Chicago, Ill., contains a description of the Austin motor sweeper, which is claimed to solve practically all of the street cleaning problems of a modern city.

WHY USE TILTING MIXERS?

The Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio, in its latest catalog tells why more than half the mixers in use to-day are of the tilting type, made so popular by the 18 different models of Jaeger mixers.

AN EXCAVATOR THAT MAKES BOCSTERS

The reason why Buckeye excavator owners are so enthusiastic over their machines for digging sewer, water pipe and drainage trenches, is told in the latest literature of the Buckeye Traction Ditcher Co., Findlay, Ohio.

AN INEXPENSIVE HOIST FOR DUMP BODIES

An efficient hand hoist for dump bodies up to 3½ tons capacity, which occupies but 9 inches of space and produces a dumping angle of from 35 to 45 degrees, depending on the body length, is described in the literature of the Rock Mfg. Co., Waterloo, N. Y.

VALUE IN MOTOR TRUCKS

The reason why many successful road-building contractors throughout the country have sent in repeat orders for GMC trucks will be found in the literature of the General Motors Truck Co., Pontiac, Mich.

A PUMP FOR EVERY SERVICE

The Aldrich Pump Co., Front and Gordon Sts., Allentown, Pa., will be pleased to send its catalogs to contractors having any pump problems, as there is an Aldrich pump for almost every service.

CURING CONCRETE IN COLD WEATHER

If you have never tried Dowflake for concrete curing operations in cold weather, send at once for the new Dow book, "How to Cure Concrete," which may be secured from the Dow Chemical Co., 361 Jefferson St., Midland, Mich.

ONE SHOVEL FOR MANY JOBS

The Keystone shovel, a highly versatile traction steam shovel, which is usable with three different interchangeable scoops for road grading, trenching, back filling, cellar digging, pit mining, loading, unloading and handling materials, is described in detail in the literature of the Keystone Driller Co., Beaver Falls, Pa.

HOW TO PUMP ASPHALT AND TAR

Iroquois Bulletin No. 9, issued by the Iroquois Sales Dept., the Barber Asphalt Co., Land Title Bldg., Philadelphia, Pa., describes Iroquois steam-jacketed pipe fittings, which are especially recommended for asphalt paving plants and all works where asphalt and coal tar must be pumped.

FINISHING ROAD JOBS QUICKLY

To finish a job quickly, labor-saving machinery is necessary. A Burch stone spreader attached to the back of a truck dumps road materials to a required depth and grade. It is described in detail in the literature of the Burch Plow Works Co., Dept. B-10, Crestline, Ohio.

DRILLING HOLES IN CONCRETE

The bulletins of Thomas H. Dallett Co., Philadelphia, Pa., describe the Dallett Baby Plugger for drilling holes and cutting ducts in concrete. This company also makes concrete bushers for bushing concrete surfaces and a full line of hand tools for concrete work.

THE ADVANTAGE OF SCOOP CONVEYORS

In a new folder, the Portable Machinery Co., Passaic, N. J., describes in detail its scoop conveyor with a 12-inch belt which has the same capacity as a 20-inch troughed conveyor belt.

A PERMANENT FIRE-PROOF FLOORING

The American Mason Safety Tread Co., Lowell, Mass., will be glad to send a copy of its 16-page booklet, "Karbolith—The Modern Permanent Fireproof Flooring, Sanitary Base, and Wainscoting," to building contractors and others interested in this desirable flooring.

TRENCH, SEWER, DITCH AND MUD PUMPERS

In Bulletin 23-T the Domestic Engine and Pump Co., Shippensburg, Pa., describes Domestic trench pump units, made in single and double diaphragm units and also as force pump units, gasoline or electric driven.

A BOOK ON LOCOMOTIVE CRANES

In its Golden Anniversary catalog, Book 115, the Industrial Works, Bay City, Mich., has issued a book of particular interest to contractors. It describes with illustrations, engineering data and performance records, rail, traction and crawling tractor locomotive cranes, wrecking cranes, wharf, barge and gantry cranes, transfer and pillar cranes, railway pile drivers, combination crane pile drivers, portable rail saws, transfer tables, steam pile hammers and buckets. The introduction contains a complete history of cranes, followed by descriptions of the Industrial Works plant and then sections on the various types of cranes.

A SELF-ANCHORING STUMP PULLER

In Bulletin 10, issued by Monarch Tractors, Inc., Watertown, Wis., contractors will find an interesting description of a motor-driven stump puller which does not need to be tied up to other stumps or trees when clearing a field of stumps.

SINGLE-LINE BUCKETS

The Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa., in its Bulletin No. 812 describes the Blaw-Knox single-line clam-shell buckets in a manner which will interest contractors engaged in all kinds of material handling.

A CONVERTIBLE ONE-MAN EXCAVATOR

Contractors will be interested in an excavator with interchangeable skimmer and ditcher booms with ⅝-yard skimmer or ditcher scoops, shovel booms handling ¾-yard shovel dipper, dragline boom handling ½-yard dragline bucket or 30, 35 or 40-foot crane boom for bucket operation. This machine is known as the Model 16-B Bay City excavator and is described in detail in Bulletins 13-16 which have recently been issued by the Bay City Dredge Works, Bay City, Mich.

A HALF-BAG TILTING MIXER

Folder 1011 issued by the T. L. Smith Co., Milwaukee, Wis., describes the new Smith 4-S half-bag mixer, which has many points adaptable for small jobs where a small amount of good concrete is necessary.

A NEW ¾-YARD GASOLINE SHOVEL

In Bulletin F-201-S, the Bucyrus Co., S. Milwaukee, Wis., describes in detail its new ¾-yard gasoline shovel, which has an ingenious rope thrust arrangement which does away with engines, gears, clutches, chains and shafting on the boom.

LIME IN CONSTRUCTION WORK

The Central Division of the National Lime Assoc., 77 W. Washington St., Chicago, Ill., has issued a very helpful booklet, "Nineteen Stories of Lime," which it will be pleased to send to any builder or general contractor or city official interested in improved construction work generally.

INVESTING IN ROAD MACHINERY

Whether it is a question of a steam or a motor road roller, scarifier, or grader, it will pay the contractor or city official interested to investigate the road machinery made by the Bucyrus Road Machinery Co., Bucyrus, Ohio.

FIRE SERVICE METERS

The unqualified approval of the Underwriters' Laboratories, Inc., has been given to the Protectus fire service meter in all sizes from 3- to 10-inch, made by the Neptune Meter Co., 50 E. 42nd St., New York City. Full descriptive literature covering this meter may be secured free by any interested parties on request.

HIGH-QUALITY CEMENT

The Pennsylvania Cement Co., 131 E. 46th St., New York City, will be pleased to quote contractors on genuine "Pennsylvania" portland cement of high quality for general concrete construction work.

A SUPER-GRADER

The Russell Super-Mogul road grader is described among other road machines and elevating graders in the complete catalog which may be secured free from the Russell Grader Mfg. Co., Minneapolis, Minn.

FALL AND WINTER CONCRETING

Full details regarding the value of Solvay calcium chloride for concrete curing, which does away with the old, expensive and laborious cover-and-sprinkle method on concrete roads, and its value for helping concrete setting in cold weather, are given in the literature of the Semet-Solvay Co., Syracuse, N. Y.

A 1¼-YARD HEAVY-DUTY STEAM SHOVEL

Bulletin 236 issued by the Osgood Co., Marion, Ohio, describes the Osgood 1¼-yard heavy-duty steam shovel with its many distinctive features.

HOW TO ABSORB ROAD EXPANSION

Elastite, a recognized expansion joint for taking care of expansion stresses in concrete, brick and wood block paving, floors, roof decks, riprap or other similar construction, or in concrete or masonry bridges, viaducts, stadia, retaining walls or other structures is described in the literature of the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio.

TRACTORS THAT PAY THEIR WAY

The C. L. Best Tractor Co., San Leandro, Calif., will be pleased to furnish to contractors a list of near-by users of Best "30's" or "60's" in order that they may see these tractors at work paying for themselves.

BUILDING CONCRETE ROADS

The latest literature of the Truscon Steel Co., Youngstown, Ohio, describes in detail Truscon wire mesh, which comes in flat sheets for road reinforcement. It also describes Truscon contraction joints, which provide a definite plane of weakness in the pavement, forming a straight crack for contraction or expansion. A dowel in the plate provides stiffness, and the interlocking prevents one section rising above the other.

A CONCRETE MIXER TO LIVE WITH

In its literature the Ransome Concrete Machinery Co., 1772 Second St., Dunellen, N. J., tells a lot about the work of concrete mixers and tells why the Ransome gives less trouble and turns out a good mix in the shortest time.

Excavating for the Bronx Terminal Market, New York

New Market Expected to Lower the Cost of Fresh Vegetables to New York Housewives

WITH the cessation of the World War, prices of some commodities went down a trifle, then ascended to war-time levels, and gradually fell, until they assumed their own normal position with relation to the decreased buying power of the dollar. Fresh fruits and vegetables, however, never discontinued their steady rise, with the exception of certain moments when the market would become temporarily overstocked, causing a flurry in prices, which afterward immediately rose again.

One of the chief reasons for this rise and steadily maintained high level of prices for fresh fruits and vegetables, is the lack of proper terminal facilities where perishables can be handled quickly, displayed, and rapidly absorbed by the small jobber and retailer, and thence find their way into the hands of the consumer at a minimum cost but with no decrease in profit to the jobber and retailer.

New York is a city which proposes at least to partially solve the handling and display problem, with its new terminal known as the Bronx Terminal Market. This market is under construction at 152nd and Exterior Streets on the Harlem River, and adjacent to the New York Central Railroad lines and river docks. Briefly, the purpose of this terminal is to provide facilities for the handling of fruits and vegetables in New York City, and more especially in the borough of the Bronx. Walter P. Hedden, of the United States Department of Agriculture, in a preliminary report on terminal conditions at the Port of New York, says, "Nothing is more certain in regard to the handling of fruits and vegetables in New York City than that the terminal facilities now provided are rapidly becoming utterly inadequate." Car-float and pier-station operation, breaking bulk with each commercial operation, and long truck hauls in and out of the central market, with consequent spoilage at every turn, are those elements which increase the expense and cost to the consumer. At one pier alone in New York City, the car arrivals were 4,405 in 1900, and 22,640 in 1920, an increase of 500 per cent in twenty years. This Bronx Terminal Market will allow the jobber and small retailer to inspect and buy their produce within a reasonable distance from its ultimate destination, and at the same time save considerable rehauling.

DERRICKS, CLAM-SHELL BUCKETS, PILE DRIVER AND AUTOMOTIVE EQUIPMENT ON THE BRONX TERMINAL MARKET FOUNDATION JOB

H. P. Converse of Boston, Mass., who is the engineer and contractor for building the large foundation piers for the market building, is using derrick equipment for excavation, utilizing ten Blaw-Knox clam-shell buckets for this job, as it was demonstrated that the clam-shell, in this particular instance being the most flexible equipment, was also the most economical. With the proper spotting of the derricks and clam-shells to cut the entire job, it was possible to dig the material out of the pier holes and load it directly into trucks without rehandling. Although there are ten clam-shell buckets on the job, not all of them are in use at one time, as some of the derricks

are in constant use for either handling the piles or sheathing. This means that about 50 per cent of the derricks are doing bucket duty, the remaining 50 per cent being reserved for other work. Regardless of this, however, the day's average for excavated material has been about 900 yards.

The rotation of operations is as follows: Derricks handling clam-shells first excavate, dumping the material in trucks. The derricks then put the piles in place and drive them with a pile driver. The derricks are now utilized to place the sheathing and also drive it with pile drivers. These three operations completed, the only thing that remains is to mix and place concrete for the foundation piers.

Building the Temporary Church at Ste. Anne de Beaupré

By William J. McNulty

THE construction of a temporary church at the shrine of Ste. Anne at Ste. Anne de Beaupré in thirty-seven days was the accomplishment of C. Emil Morrissette, of Quebec, one of the leading building contractors of Canada. The Redemptorist Fathers, who exercise full supervision over the shrine and administer its affairs, decided, in view of the crowds visiting the shrine, to erect a temporary church to replace the old basilica, which was destroyed by fire, said to be of incendiary origin.

The Redemptorist Fathers intended to build only the new basilica. Mr. Morrissette was asked if he could build a temporary building to house worshippers at the shrine. It was estimated that three months would be necessary to complete construction on a wooden building, 140 x 60 feet. Mr. Morrissette surprised the Fathers when he offered to complete the building in two months, and he surprised himself when it was finished in thirty-seven days.

Mr. Morrissette turned in this feat by coordination of all departments. Each of his employees had his duties to perform and was expected to fulfill these duties promptly and in detail. There was none of the confusion so familiar in many building projects where speed is the prime essential. An estimate was made of the work to be done daily by each employee, and he was expected to keep up to schedule. Those employees who fell below the estimates dropped behind in the race, there being a bonus for the leaders.

A very noticeable feature of the construction at the shrine of Ste. Anne is the entire absence of profanity among the workmen and superiors. The anti-profanity rule is strictly enforced. The Redemptorist Fathers decided that Mr. Morrissette deserved some recognition for his speed and efficiency, and placed wooden signs about the temporary church, reading in both English and French, "This church was built in thirty-seven days by C. Emil Morrissette, of Quebec."

In addition to the contract for the temporary church, Mr. Morrissette received the contract for the construction of the Redemptorist College at the shrine, a building of five stories in yellow brick. All the buildings at the shrine of Ste. Anne are being built by the contributions left by the pilgrims and visitors. That these reach an important figure is realized when it is stated that the various buildings, the temporary wooden church, the college, the rectory made of stone from the devastated basilica, and the new basilica will cost about two million dollars. It is planned to spend one million on the new basilica alone.

It is estimated that six years will be consumed in constructing the new basilica, a start on which was made recently. There are two reasons for the extended period of construction. The first is the necessity of delay because of financing on weekly payments secured from the offerings of pilgrims at the shrine and the numerous connecting buildings, including churches and chapels. The second reason is the size and beauty of the edifice. The new basilica will be one of the largest and most beautiful churches in the world. There will be seating accommodation for 6,000. The altars will number 26. The church will be 300 feet long, 200 feet wide, and 100 feet high, or about twice the size of the burned basilica.

Contracts Let for Eleven New Road Jobs in Minnesota

On Latest 75 Miles of Grading and Other Work Prices Are Lowest Since the War

CONTRACTS have recently been announced by Charles M. Babcock, State Highway Commissioner of Minnesota, for 75 miles of new grading, 6 miles of gravel surfacing, 7½ miles of paving, and 13 new bridges. These betterments are well distributed over the entire road system, and while they are made possible largely by county reimbursement bonds, are in order under the state program. A large number of the jobs went to local contractors, and this is attributed to advance notices published free by newspapers throughout the state. These projects and others to be put under contract this fall will virtually complete surfacing on all grading done under the new highway program.

A new type of steel cable guard-rail has been adopted by the Highway Department, and under a contract awarded on the lowest bid about 150,000 lineal feet was purchased at 22 cents a lineal foot installed. The service of this new guard-rail will be watched with interest.

An Innovation in Apartment House Construction

Two-Inch Solid Partitions Used Throughout New 60-Suite Apartment Building in Evansville, Ind.

THE Donaldson-Arms apartments, recently completed in Evansville, Ind., are built according to a system of reinforced concrete construction, using ribbed metal lath in place of wooden forms. This is said to be the most modern method of construction, and while nothing has been sacrificed in the way of strength and beauty, because of its labor-saving quality and the elimination of expensive form work, it can be erected at a lower cost than other types of concrete construction. Self-Sentering, a special type of metal lath, which acts not only as the form, but becomes a part of the reinforcing steel of walls, columns and beams, is used in the system. This lath, made by the General Fireproofing Company, Youngstown, Ohio, is placed in the proper position for the formation of a beam or a colmun, and is then held rigidly in place by shoring. The lath is used not only as forms for beams and columns, but also for floors, roofs and basements and exterior walls.

BEGINNING OF CONSTRUCTION OF THE DONALDSON-ARMS APARTMENTS, SHOWING BASEMENT AND GROUND FLOOR POURED

This system employs a type of column and beam which is coved so that when a column appears at the corner of a room, considerable space is gained by having a concave surface at the intersection of the walls. This is also true in the case of the beams, resulting in a coved ceiling, which is very pleasing from an artistic standpoint. Moreover, the coved corners appeal to housewives because they do not hold dirt or dust like square corners.

The same kind of lath is used for floor forms, partitions and the exterior walls of the building. After the lath has been erected for the columns and beams and for the floor which they are to support and this lath has been held in place by the proper shoring, the concrete is poured. It has been proved that concrete poured into forms of metal lath developed greater strength than when poured into closed forms, the reason for this being that all

A FLOOR LAID AND PARTITION WALL AND CEILING REINFORCEMENT READY FOR FINISHING COAT

of the excess water of the concrete which must be used to secure an intimate mixture of the material used, is squeezed out through the holes of the metal lath and only a sufficient amount remains to insure the proper setting of the concrete.

As the concrete is poured into the lath forms, it penetrates through the holes far enough to make little lugs, and these provide a rough surface for holding the plaster with which the members are smoothed or finished.

After the beams, columns and floors have been poured, the exterior and the partition walls are formed. For the exterior walls, one thickness of lath is plastered with cement plaster on both sides, making a 2-inch reinforced wall. Four inches from this outside wall is erected another run of lath, which is plastered only on the inside. The result is a double wall having a dead air space of nearly 4 inches, which secures not only a dry wall, but a wall proof against changes in temperature and one that is strictly fire-proof.

The partition walls are made of one thickness of lath, plastered on both sides, and so rigid are these partitions that one can strike them violently with a sledge without evidences of vibration.

A Self-Anchoring Stump Puller

Three-Wheel Chassis Can Be Anchored Without Tying to Stumps or Trees

A NEW stump puller which is carried on a 3-wheel chassis and has proved successful for pulling stumps, anchoring itself without the necessity of tying it to trees or stumps, has been developed by Monarch Tractors, Inc., Watertown, Wis.

A large-diameter axle passes through the two rear wheels and supports the heavy steel channel frame, which has the anchor built into the rear end of it. It carries a power-plant and a cable drum at its opposite ends. Pivoting the frame over this axle allows the anchor blade to drop down into the ground when pulling, while in hauling the machine over the road the front end of the frame is pulled down to a horizontal position by means of a crank and cable attached to the chassis frame.

Practically all of the weight of this machine is so located as to counterbalance the cable pull. Some additional weight is necessary to counterbalance the heaviest pull. This weight is hung from the boom held in position by guy-ropes attached to the frame. The boom also serves as a tongue when using horses to move the machine and is then clamped in place over the short tongue on the castor wheel, which is mounted in front and permits short turns. The short tongue is fitted with a tractor hitch.

In operating the machine a crew of four men will keep the stump puller working to capacity —one operator, two men handling cables and one man on a tractor or team. The self-anchoring device enables the operator to select the most convenient and advantageous position from which to operate the stump puller in clearing half an acre or more of stump land at one setting. After placing the machine in position and hooking the cable around the stump, the first pull of the cable draws the machine forward. The sharp blade of the anchor is set at an angle which forces it into the ground until it will hold the heaviest pull the machine will develop. As soon as the anchor is set, the cable is run through a pulley block attached at the center of the anchor blade. This permits the cable to pull off at a sharp angle and cover a wide strip of ground close to the machine. The cable drum is not intended to hold more than 50 feet of cable, as it is not necessary to pull in more cable than is required to get the stump out of the ground. This is accomplished by using several short cables, 50

THIS MACHINE ANCHORS ITSELF ANYWHERE FOR ITS JOB OF PULLING OUT STUMPS

For Constructing Roads and Maintaining Them

No other machine or method approaches the "Caterpillar's" long record for building and maintaining good roads and streets. All over the world you will find "Caterpillars" doing this important work at the lowest possible cost and the greatest practicable speed. Counties, cities, contractors, and engineers pronounce the "Caterpillar" unequalled in performance, real economy, and continuous power.

The "Caterpillar" gives these same fine qualities to other jobs requiring superior tractive power and endurance, such as important engineering projects, reclamation, dirt moving, irrigation, moving machinery, materials, or products cross country, or logging.

Let us figure with you on your power needs. Our booklets "Caterpillar" Performance and "The Nation's Roadmaker" sent upon request.

** There is but one "Caterpillar"—Holt builds it*

THE HOLT MANUFACTURING COMPANY, *Inc.*

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Canadian Holt Company, Ltd., Montreal

feet long, coupled together. These cables are dropped off as the work nears the puller.

The manufacturers claim that only 10 minutes is required to wind in the cable, pull the anchor out and set up in a new position, ready for operation. This is a distinct advantage to contractors where mobility is an essential factor in cleaning up a job.

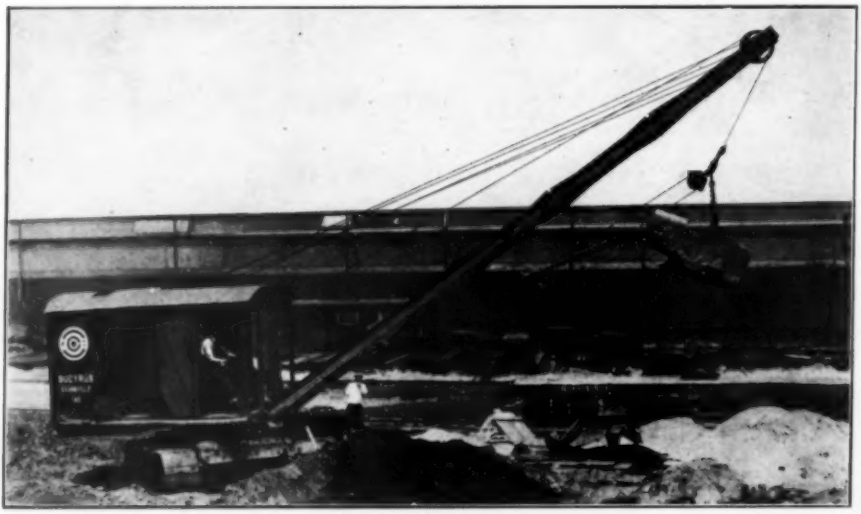
A New ¾-Yard Gasoline Shovel

Engines, Gears, Clutches, and Chains Removed from the Boom by Use of New Rope-Thrust

A NEW ¾-yard gasoline rope-thrust revolving shovel, known as the 20-B, has recently been announced by the Bucyrus Company, South Milwaukee, Wis. This shovel contains the same features that are embodied in their 30-B gasoline machine, which has been on the market for about a year.

The ingenious rope-thrust arrangement, patents on which are held by the Bucyrus Company, not only does away with the necessity of engines, gears, clutches, chains or complicated shafting on the boom, but at the same time gives this shovel a drive behind the thrust more powerful than it is possible to obtain with a steam shovel of the same size, since the whole power of the main engine is behind it. This device is said to have proved itself on the 30-B shovel under the toughest digging conditions in all parts of the world, and its manufacturers believe that it has literally created in itself a new era for the small shovel driven by an internal combustion engine.

Briefly stated, the shovel is driven by a single, slow-speed gasoline engine. The motions of the dipper handle are controlled by a small drum on a shaft under the boom, a shaft which has keyed to it pinions for engaging with the racks on the handle. The drum is turned either way by two ropes leading to drums in the main machinery.



NEW 20-B GASOLINE SHOVEL EQUIPPED WITH 35-FOOT BOOM AND ¾-YARD DRAGLINE BUCKET

The striking fact about the performance of this shovel is the ease with which the operator can control the motions of the dipper, even to shaking it to relieve it of sticky material. The shovel may also be had with high lift or extra high lift booms, or with dragline, clam-shell excavator or crane attachments.

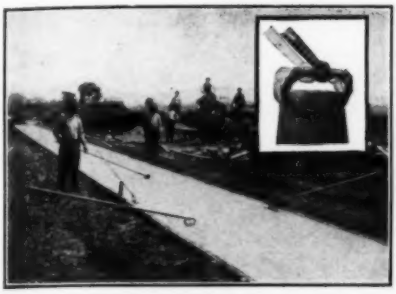
The control is simple, and the machinery is arranged with the convenience of the operator in mind. Whatever clutches are necessary are sufficiently large to obviate the danger of burning.

Worth More Than They Cost

Some of us who make a lot of noise about the cost of good roads would likely make even more if we had to go back to the old roads of only ten years ago.

—*LeSueur Center (Minn.) Leader-Democrat.*

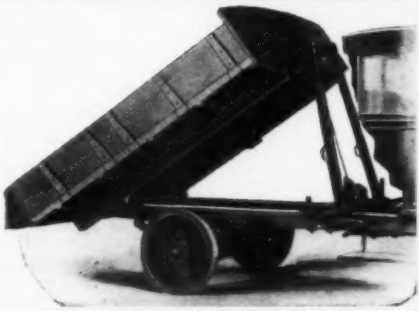
A PERFECT SURFACE
with Inexperienced Help



The "ABRAM" Double Action Trowel

This tool makes it easier to surface concrete roads or side-walks. The Abram Trowel never gouges the concrete and with it an inexperienced man can, with an hour's practice, do first-class work.

ABRAMS CEMENT TOOL CO.
3818 Grand River Avenue, Detroit, Mich.



ROCK HAND HOIST

A highly efficient, well designed and carefully built hoist for dump bodies up to 3½ tons capacity.
Cut gears are used on the winch.
Can be mounted on any width of chassis without change.
Occupies but 9 inches of space.
No holes are required in truck frame for mounting hoist.
Dumping angle, 35 to 45 degrees, depending on body length.

PRICE, WITH BODY HINGE, $85.00.
ROCK MFG. CO., Waterloo, N. Y.

for Concrete Curing

Roads may be released for service in as little as ten days' time by curing with

SOLVAY
Calcium Chloride

State and County Engineers wherever Calcium Chloride Curing has been used are unanimous in their commendation.
Does away with the old, expensive and laborious cover and sprinkle method. Saves time and money.

Write for full details to

SEMET-SOLVAY COMPANY
Syracuse, New York

CONCRETE DRILLING

Baby Plugger for drilling holes and cutting ducts in concrete.

Concrete Busher for bushing concrete surfaces.

A full line of Hand Tools used daily in your trade.

Bulletins:
No. 1043
No. 1044
No. 1045

THOS. H. DALLETT CO.
PHILADELPHIA, PA.

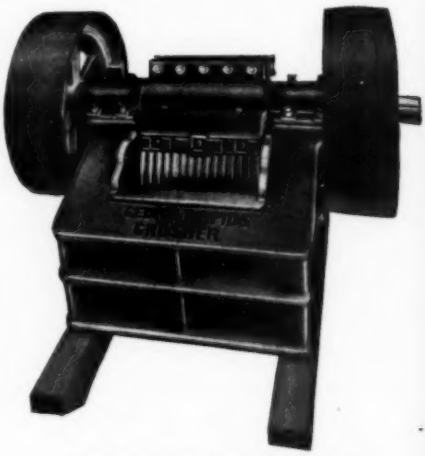
A New Force-Feed Jaw-Type Crusher

Machine Is Claimed to Reduce Crushing Costs Because of Simplicity of Design

THE crusher illustrated below is claimed by its maker, the Iowa Manufacturing Company, Cedar Rapids, Iowa, to combine the advantages of a powerful machine, designed specially for its work, with a simplicity of working parts that assures continuous operation free from mechanical difficulty. The base of the crusher is ribbed where the greatest stresses lie, and in all but the two smallest sizes the base is made of cast annealed steel, giving maximum strength with minimum weight. There are only three bearings, and each of these is made of heavy phosphor bronze, carefully machined. Power is delivered direct from a heavy drop-forged steel shaft of large diameter, thus eliminating all gears and transmissions and aiding in the simplification of the machine.

The fly-wheel is counterbalanced to give maximum power at the moment the crushing impact occurs. There is an unusually large amount of metal throughout the bearings in the two larger sizes. To forestall the heating of these bearings, a water-cooling system has been installed. The oiling system is direct, with no force pumps or oil lines. Every part of the crusher is interchangeable and easily accessible, making the replacing of worn parts a simple matter.

The adjusting mechanism makes it possible to set the crusher and produce a uniform product. Only a few changes are necessary to regulate the sizes of stone anywhere from 3 inches down to ½-inch. The adjustment can be made without stopping the machine or even cutting off the flow of material into the hopper, thus eliminating serious delays and expense, as well as loss of production.



A POWERFUL CRUSHING UNIT

It is claimed that this crusher will handle trap rock, boulders, gravel, shells or any other refractory materials with ease, and that the machine is adaptable to any and all sections of the country where crushable material is found, regardless of its quality or nature.

Excavating Company Adopts "Corduroy" as Name for Its Continuous-Traction Tread

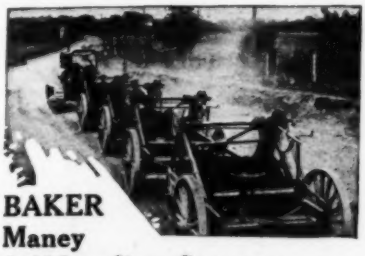
ACCORDING to the Standard Dictionary, a corduroy road is a rough road, usually over miry ground, made of transverse logs touching one another. The first corduroy roads were built at the very beginning of the nineteenth century. They were the first attempts to counteract the evils of heavily rutted earth roads and they enabled heavy loads to be transported over marshy or swampy ground.

Corduroy roads have also been used extensively in logging operations and are still used in some sections of the country. The moving of a heavy load over soft ground is a problem similar to that of driving a team and wagon through a swamp; that is, the weight of the machine must be distributed over a large area. In this way the pressure on the ground is kept within the supporting power of the soil, and the load can travel without miring down and causing much lost time.

Excavators usually are called upon to do considerable traveling over soft ground. The first machines which were mounted on wheels used mats when operating in or crossing soft soil. The mats really amounted to short sections of corduroy road, which were transported with the machine. They were picked up from the rear as the machine traveled along, and placed at the front again, an effective but slow process.

The excavators made by Pawling & Harnischfeger Company, Milwaukee, Wis., were developed on the principle of carrying and laying their own corduroy roads. The traction consists of an endless chain of steel treads, which are, in effect, the logs of a corduroy road, since they lie close together and form a path on which the machine travels. This corduroy is laid ahead of the machine and is picked up again at the rear in a continuous and automatic manner. The first machines built by this company had blocks of wood bolted crosswise onto the endless chains of the traction device, and this developed the use of the descriptive name "Corduroy" for the traction used on these excavators to differentiate its type of traction from all other similar types of endless-chain traction.

BIG YARDAGE with a SMALL GANG



BAKER Maney Self-Loading Scrapers

Think of 300 to 600 cubic yards of dirt a day with a grading gang of only two or three men! That's all it takes on a train of three to six Baker Maneys. It's easy to handle such a gang.

Slow moving team outfits are a thing of the past. The improved Steel Baker Maney Scrapers with powerful structural frame construction and short turning radius are meeting every demand behind the big tractors.

Send for Catalog No. 96-A — Let us show you how to use Baker Maneys at a big profit.

The BAKER MFG. CO.
585 Stanford Ave.,
SPRINGFIELD, ILLINOIS

Put a Train o' Maneys on your Job

MOST REASONABLY PRICED MIXER IN AMERICA

BUILT IN ALL SIZES AND TYPES

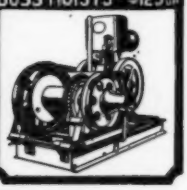
Get New Prices—Terms. Just off Press.

The American Cement Machine Co., Inc.
Keokuk Iowa
THE GATEWAY CITY

Branch Offices In All Principal Cities

BOSS MIXERS ½ to 5 S.A.E. Sizes

BOSS HOISTS - $125 up



SCARIFYING WITH AN AUSTIN MOTOR ROLLER

It has been the experience of thousands of contractors and road officials that the motor-driven type of roller is far superior to the steam type in all around efficiency.

The motor roller is a time-saver. The operator wastes no time fussing with his water and fire. He devotes his entire attention to rolling and more and better work results. This means that the rest of the gang has to work faster to keep up with the roller so money and labor are saved as well as time.

You can share the experience of these thousands of boosters for the Austin Motor Roller. Special Catalog F tells all about it. Drop us a card and we'll send you one by return mail.

THE AUSTIN-WESTERN ROAD MACHINERY CO.

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Branches, Warehouses and Service Stations in 23 Cities

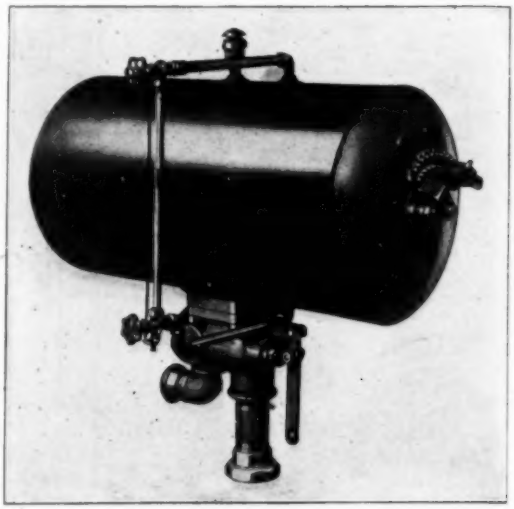
EXPORT DEPARTMENT
ALMACOA — ALLIED MACHINERY COMPANY OF AMERICA — ALMACOA

New Water-Measuring Tank for Concrete Mixer

Novel Device Easily Regulated

THE new water-measuring tank made by the T. L. Smith Company, Milwaukee, Wis., for use on its concrete mixers and pavers, has several unique features. The device by which the water is measured consists of an open-top trough, pivoted at both ends within the watertight outer shell of the tank. By tilting the trough at different angles it is made to hold more or less water, and in this way to regulate the amount of water that can be drawn from the tank.

In using this new device, the operator first allows the water to run into the tank and fills it full. Then, as soon as he is ready, he opens the valve at the bottom of the tank and allows the water to run out of the tank into the mixer drum, but water which is held in the trough cannot run out. The amount of water that does run out is equal to the tankful, less the amount held in the trough. By tilting the trough so that it will retain less water, more water is permitted to flow from the tank. When the trough is tilted to a position where it will no longer hold any water, the entire capacity of the tank can be drawn off.



NEW MEASURING TANK FOR WATER FOR CONCRETE MIXERS

The short arm shown at the right of the illustration at the end of the tank enables the operator to set the trough in the position that will allow just the right amount of water to be drawn off for each batch. A graduated sector indicates the amount of water being used. A lock is provided so that the arm may be fixed at any point along the sector.

Water enters and flows out of the tank through a 2½-inch valve located at the bottom of the tank, insuring fast filling and emptying. This tank is equipped with a piston-type, two-way valve. The piston operates horizontally, and the seating surfaces, which are rubber and finished cast iron, are in a vertical position. This makes it practically impossible for dirt to cling to the seating surfaces, because the incoming or outgoing water continually washes them clean. Any dirt that may be caught in the valve will drop to the bottom of the valve housing, where it can do no damage and from which it can be drained off occasionally through a small plug.

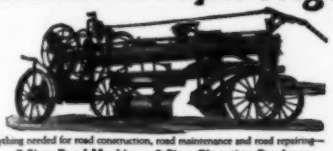
Bates Experimental Road Passes into History

THE Bates experimental road near Springfield, Ill., which was built for the purpose of making traffic tests to determine the most suitable type and design of pavement surface under Illinois conditions, is now being torn up. The road will become a part of the Springfield-Jacksonville Highway, which has been completed on each end of the experimental road. Those sections of the Bates road which have successfully withstood the tests will be retained in the permanent road after having been given such repair as may be necessary to make them a part of a good riding surface.

The new construction necessary will be a standard Illinois section, 6 inches thick at center, spreading to 9 inches at each edge. Those sections which were built of this design late last year have successfully withstood the traffic tests, the final increment having been 13,000 pounds on each rear wheel.

The Bates road tests have been decidedly worth while, because of the general recognition accorded them by engineers and highway builders and because of their influence in modifying highway design in many states throughout the country.

The Russell Super-Mogul



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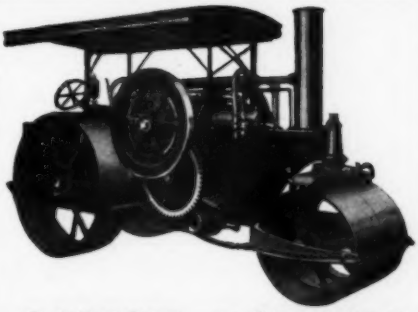

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American Buildings Withstand Japanese Earthquake

AMERICAN steel concrete buildings in Tokyo and Yokohama withstood the earthquake shock and are in good condition, according to a cable from Assistant Trade Commissioner G. C. Howard at Kobe. Officials of the Department of Commerce expressed gratification over the first practical demonstration of the effectiveness of the new so-called earthquake-proof factories and office buildings which have been constructed within the past three years. There are about six of these buildings in Tokyo. The fact that this construction has proved earthquake-proof is likely to influence favorably the adoption of this type of construction in the future.

The Assistant Trade Commissioner also cables that export as well as import shipments probably must be made via Kobe for some time. Kobe, on the Island Sea, is 200 miles outside the devastated area. It is the chief import center of Japan and is surpassed only by Yokohama in export trade.

New Asphalt Paving for Fayette County, W. Va.

EARLY this year a $400,000 bond issue was voted upon favorably by the citizens of Fayette County, W. Va., for road-building purposes. Contracts have recently been let for the first of this paving. The contract to pave the Fayetteville-Cold Run Road with 35,250 square yards was awarded to Waugh Brothers of Fayetteville, W. Va., while the contract for paving the Mt. Hope-Pax Road with 50,492 square yards was awarded to two contractors, the Fidelity Construction Company of Mt. Hope and the J. M. Randish Company. Previous to the taking of bids for these two roads on August 6, Waugh Brothers were awarded a contract to pave the Oak Hill-Longally Road with a yardage of 22,430 square yards. Both the Fayetteville-Cold Run Road and the Mt. Hope-Pax Road are to be paved for a total length of 21 miles with asphalt macadam, using Bermudez road asphalt.

First Step in Simplifying Prepared Roofing

AT a meeting held September 26 at the Department of Commerce with representatives of the Division of Simplified Practice and the Chamber of Commerce of the United States, manufacturers, distributors and consumers of prepared roofings agreed to the following simplification as being of benefit to the industry and to the public at large:

1. To eliminate all grades or kinds of slate-surfaced and stone-surfaced prepared roofings that do not measure up to the requirements of the Class-C label of the Underwriters' Laboratories.

2. To reduce the variety of smooth-surfaced roofings to seven lines or grades, the weights and qualities of which are being considered.

This simplified practice recommendation is to become effective January 1, 1924, and is to hold for one year. Prepared roofing is a product used all over the world, not only as a roofing material, but in cane fields and elsewhere for keeping weeds down and retaining moisture and warmth. It is believed that this program will bring many economies to the manufacturers, such as decreased idle stocks, less idle investment, and ultimately lower production costs, and will benefit the distributors by stimulating the turnover and increasing sales. Consumers will also benefit in due time through better quality, better prices, and quicker service.

News and a Book Review

Truscon Moves Michigan Office

THE Truscon Steel Company has announced that its Detroit, Mich., office has been removed to the second floor of 615 Wayne Street. The office will contain the complete service organization and engineering department and will furnish information, estimates and details on all Truscon steel products, including reinforcing steel, metal lath, steel windows, steel joists, highway reinforcing, standard buildings, inserts, foundry flasks, platforms and pressed steel parts.

New P & H Representative

Pawling & Harnischfeger Company, Milwaukee, Wis., has announced the appointment of N. B. Norris as manager of the New Orleans office at 938 Whitney-Central Building, and also the opening of a new office at 1124 Book Building, Detroit, Mich., with James Van Buskirk in charge.

ESTIMATING BUILDING COSTS

By Charles F. Dingman. First Edition. VIII + 240 pp. McGraw-Hill Book Co., Inc., New York. 1923. Price $2.50.

The author states that this volume is the result of about 15 years' consideration as to the best methods of presenting to the ambitious young men in the building profession the rudiments of the knowledge required to become competent estimators. It is not designed to replace data or reference books on the subject, but is intended to form the proper habits of thought necessary to make a successful estimator, who must be able to take a set of plans and specifications with a quantity survey and mentally see the several parts of the building put together. The book is well divided into chapters which contain a large amount of cost data for purposes of illustration. The chapters cover excavating, grading and bracing, brickwork, stonework, cement block work and architectural terra cotta, fireproofing and fire-proof construction, plain and reinforced concrete, timber framing, boarding, planking and shingling, finished carpenter work, structural steel and iron work, steel sash, lathing, plastering and stucco work, painting and paper hanging, roofing and sheet metal, damp-proofing and waterproofing, short-cut methods of estimating, and a summary which contains some particularly good advice.

Distributors of Contractors' Equipment

THE following cards (arranged by states) show the names of dealers in contractors' equipment and supplies with a record of the various lines handled. Contractors will find this list a convenient means of getting in touch with dealers who make a point of giving satisfactory service and prompt shipments. This directory is constantly consulted by our subscribers and any suggestions regarding it will be welcomed. ". ". ".

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The Ironton Engine Co., Storage battery locomotives.
Insley Mfg. Company, Concrete handling equipment, steel derricks, industrial cars.
Mead-Morrison Mfg. Co., Hoists and Grab buckets.
Vulcan Iron Works, Contractors' locomotives.
The Marsh-Capron Company, Concrete Mixers.

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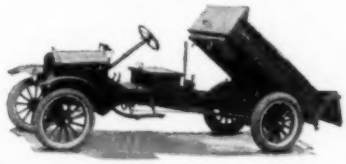

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Jan. 18, 1923—The death rate from typhoid fever in Jersey City last year was only 1.9 per 100,000 population; there were only 18 cases in the city throughout the year and only 6 deaths, said Dr. George McLaughlin, bacteriologist for the Jersey City water supply, today. Dr. McLaughlin received his figures from the report of the State Board of Health, which covers every municipality in the state.

In 1891 the death rate from typhoid in Jersey City was 102 per 100,000 population. This was when Jersey City used the old Passaic River water supply.

In 1919, when so many of the city's young men were away to war, the death rate from typhoid in Jersey City was only 1.5 per 100,000 population. That was the lowest death rate in the history of the city, but the rate of 1.9 per 100,000 in 1922 is very little higher and is really a better showing, Dr. McLaughlin said considering the greatly increased population.

In fact, the figures of this report show that Jersey City stands third or fourth among all the cities of the United States in healthiness, as far as typhoid fever is concerned, **Dr. Laughlin said, and this is due to the purity of the city's present water supply from the Boonton reservoir**

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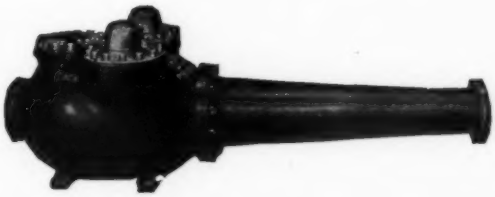

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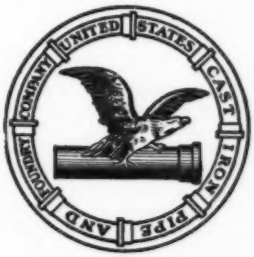

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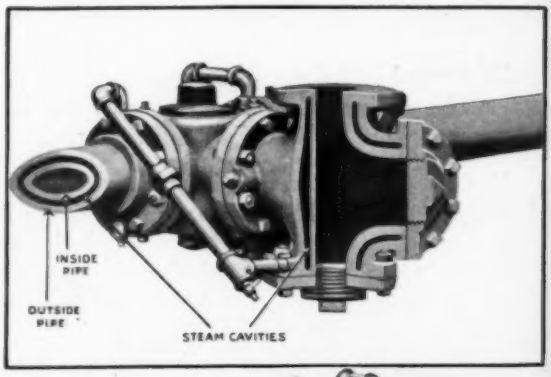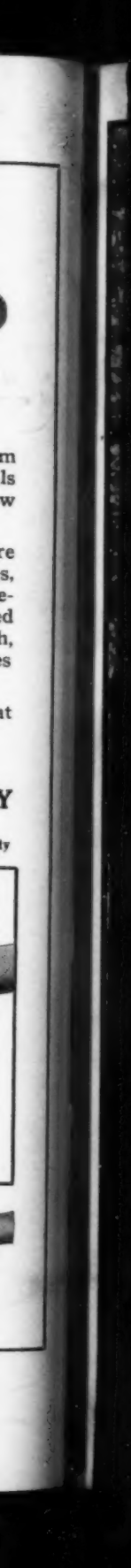
Standard Oil of Ind.
Sun Oil Company, Philadelphia
Detroit Asphalt Paving Co., Detroit, Mich.
Bird & Son, E. Walpole, Mass.
City of St. Louis, Mo.
City of Reading, Pa.
City of Windsor, Ont.
Austin Machy. Corp., Toledo, Ohio
Williams & Wilson, Ltd., Montreal, Can.
Amalgamated Roofing Co., Chicago, Ill.
Park Cramer Co., Boston, Mass.
City of Pittsburgh, Pa.
James F. Martin & Company, Monterrey, Mexico
Honolulu Iron Wks., Honolulu, T. H.
City of Kingston, N. Y.
Messrs. Suzuki & Co., New York City
Southern Construction Co., Durant, Okla.